National Aeronautics and Space Administration

2011

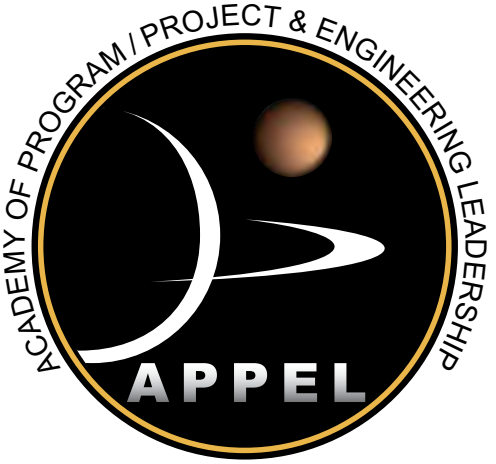
Program Catalog

NASA Academy of Program/Project and Engineering Leadership

MISSION STATEMENT

The Academy of Program/Project and Engineering Leadership supports NASA's mission by promoting individual, team, and organizational excellence in program/project management and engineering through the application of learning strategies, methods, models, and tools.

2011 Program Catalog



Office of the Chief Engineer

The NASA Academy of Program/Project and Engineering Leadership

Table of Contents

Greetings from the APPEL Director

"There is only one corner of the universe you can be certain of improving, and that's your own self."

– Aldous Huxley

The Academy of Program/Project and Engineering Leadership (APPEL) has supported the learning needs of NASA's program and project management workforce since the early 1990s. From the start, its approach to professional development has been based on NASA standards, competencies, and learning from real experiences.

Today, the Academy's mission encompasses the program/project and engineering workforce. The majority of its professional development resources go to support mission-driven engineering and project teams. This targeting of mission-specific team learning is reinforced by a vast array of courses, workshops, and forums for individual, team, and organizational learning.

This catalog is intended to be a road map for your professional development. The Academy's curriculum lies at the heart of our approach to building project management and engineering capability at NASA. It employs state-of-the-art methodologies based on leading empirical research and the latest developments in aerospace, project management, systems engineering, and adult learning in a professional context. The aim of our curriculum is to enable each and every member of NASA's technical workforce to develop both the technical skills and the leadership abilities necessary to respond with speed and vision to a constantly changing landscape.

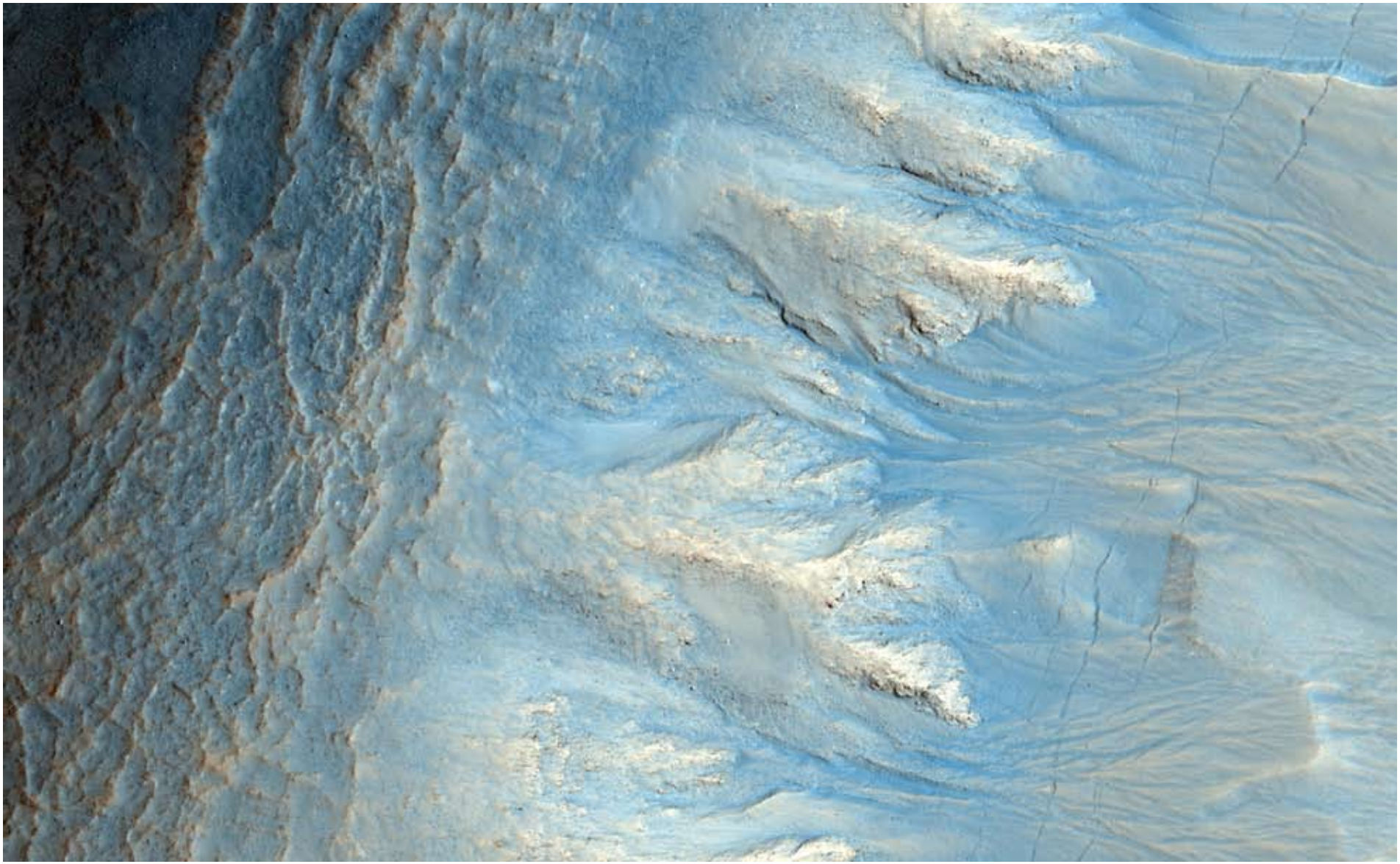
An overall curriculum structure has been developed that will help us meet this vision and provide a defined path for project managers and engineers to progress. The core curriculum comprises three levels of project management and systems engineering programs: Foundations of Aerospace at NASA, Project Management and Systems Engineering, and Advanced Project Management and Advanced Systems Engineering. The core program is augmented by elective course offerings that provide in-depth knowledge and skill development.

In short, the programs described in this catalog are a central part of the Academy's effort to set the standard for the professional development of NASA's technical workforce in order to advance the mission of the agency in its service of our nation. Please be proactive in registering for the courses that interest you, as oversubscription is common due to high demand and the limited amount of funding available. I am confident that your investment of time and effort in these programs will yield multiple rewards over the course of your career, and I encourage you to make the most of the Academy's rich opportunities for learning and professional development.

Dr. Ed Hoffman

NASA Academy Director

http://appel.nasa.gov



WHO WE ARE AND WHAT WE DO

Who We Are and What We Do

Who We Are

The Academy of Program/Project and Engineering Leadership (APPEL) is NASA's agencywide resource for the professional development of program/project managers and engineers. We are actively engaged in promoting career and professional development and providing a wealth of information and resources to the technical workforce. The Academy builds NASA's capacity for teamwork, leadership, process utilization, and knowledge through customized programs to meet the specific needs of individuals, teams, and the NASA community. Our products and services are designed to address the competencies required for project management, systems engineering and discipline engineering across four levels of career development, from team member to program manager or chief engineer. The Academy provides these products and services through four business lines: Curriculum, Knowledge Sharing, Performance Enhancement, and Formal Development Programs.

What We Do

Curriculum

The curriculum enables NASA's technical workforce to develop NASA-specific expertise and capability in project management and engineering. It is intended to supplement an individual's academic and professional work experience. The curriculum draws extensively on best practices and the knowledge of NASA subject matter experts to ensure that it addresses the needs of NASA's practitioners. The courses are developed following established instructional design processes, and include rigorous annual audits and revisions and incorporation of participant feedback. The Academy's project management and systems engineering competency models provide the basis for all course objectives.

Courses are highly interactive, featuring case study analyses, group discussions, individual exercises and simulations. Participants are encouraged to learn from instructors and one another.

The curriculum has achieved a reputation for excellence within academia and leading professional associations throughout the world. Both the Project Management Institute and the American Council on Education recommend recognition for participation in the Academy's courses.

The curriculum consists of a core curriculum and a wide array of in-depth courses. In combination with work assignments and other developmental experiences, these courses provide essential knowledge and skills that address the learning needs of NASA's technical workforce at all career levels.

Core Curriculum

The core curriculum offers a comprehensive, integrated approach to learning for NASA's technical workforce. The sequence of the materials is designed to help participants expand their thinking—to make connections among many systems engineering and project management principles and concepts, see the "big picture," and understand the context and interrelationships of the topics. This framework promotes the timely transfer of knowledge and skills into the work environment. Core courses range from the foundations of aerospace to advanced project management and systems engineering topics. Dates and locations can be found on the agency master schedule.

In-Depth Courses

The Academy sponsors in-depth courses in the areas of program/project management, systems engineering, engineering, earned value management, and communications and leadership; as well as courses related to NASA's mission, vision along with other experiential learning activities. These courses supplement the core curriculum by providing in-depth knowledge and skill development. Participants are not limited to attending courses at their home centers. Dates and locations can also be found on the agency master schedule.

What's New in Curriculum?

The Academy continually seeks to provide new opportunities for learning and professional growth. It conducts regular reviews with participants, educators and key stakeholders to ensure that the curriculum meets the changing needs of the workforce.

New courses for FY11 include (but are not limited to): Strategic Thinking for Project Success; Essentials of Astronomy for Engineers; Introduction to Green Engineering; Orbital Debris Mitigation and Reentry Risk Management; the Project Acquisition Workshop; NASA Missions: Engineering Exploration; and Space System Development: Lessons Learned.

The Academy is also proud to announce that the American Council on Education's College Credit Recommendation Service (ACE CREDIT) has evaluated and recommended transferable college graduate level credit for 12 select courses. Please reference the ACE section for more details on this exciting new benefit.

Knowledge Sharing

The Knowledge Sharing initiative promotes excellence in project management and engineering by gathering and sharing knowledge, best practices, and lessons learned from program/project and engineering leaders. This has proven to be an effective strategy for helping to build an agency-wide community of reflective practitioners who understand the necessity of continuous learning and sharing.

What's New in Knowledge Sharing?

Principal Investigator (PI) Team Forums enable NASA's PI-led mission teams to engage, share with, and learn

from fellow practitioners from a broad range of science missions through their stories, shared experiences, and lessons learned. These events are held in collaboration with the Science Mission Directorate,

Knowledge Forums bring together representatives from NASA, industry, and academia to explore issues such as knowledge networks, knowledge capture and preservation, and the challenges of managing and transferring knowledge in a project-based organization.

Masters with Masters events bring together two master practitioners to reflect on their experiences, lessons learned, and thoughts about upcoming challenges in a moderated discussion.

The Academy also hosts Masters Forums on specific topics to meet compelling new needs, such as the Green Engineering Masters Forum, which was a collaboration with the Office of Infrastructure. These targeted forums provide a means for agile learning in response to NASA's dynamic environment. Please see the Knowledge Sharing section for more details.

International Project Management

International collaboration in space has evolved significantly over the past 50 years. Nearly two-thirds of NASA's science missions now involve some level of international participation, while its human spaceflight program, which is dominated by the development of the International Space Station (ISS), is wholly international in scope, involving some 16 international partners in its development and utilization. More nations than ever before are also seeking the benefits of space.

In the years ahead, the trend toward greater international collaboration in space exploration will continue to accelerate. As this evolves, there will be increasing interdependencies among space agencies as the cost has become prohibitive for any single agency to provide full "critical path redundancy."

The Academy, in collaboration with its international partners, has undertaken a series of new initiatives to incorporate this understanding into the approach it uses to develop NASA's technical workforce. One of these initiatives has brought together space agencies, companies, educational and professional organizations to create an International Program/Project Management Committee (IPMC), under the auspices of the International Astronautical Federation (IAF), to facilitate information exchanges and foster closer collaboration.

Nearly **TWO-THIRDS** of NASA's science **MISSIONS NOW INVOLVE** some level of **INTERNATIONAL PARTICIPATION...**

Performance Enhancement

The Academy's team performance enhancement services increase a project's probability of success by delivering the right support to a project team at the right time. Through one-on-one assistance, focused workshops, or large-group sessions, enhancement interventions achieve immediate project goals, while building long-term team capabilities.

Performance Enhancement begins with a NASA project or engineering team submitting a request for support, directly to the Academy through a statement of work (SOW) that outlines a project's background and general development needs. Next, assessments and consultations take place between Academy team members and the NASA project leaders to evaluate these needs and propose developmental activities that specifically respond to the SOW. Funding can be obtained from either from the Academy or the centers concerned, depending on the nature of the project and the type of support required.

Assessment and Development

Team managers improve project and executive team dynamics most effectively when they assess team and individual behavior. Performance Enhancement tools can measure behavioral effectiveness for teams and leaders, as well as measure overall team knowledge. Following assessment, interventions can include workshops, coaching, mentoring, and individual or team consultations with experienced practitioners, many of whom are retired NASA and aerospace industry project managers.

Project Life-Cycle Support and Technical Assistance

The Academy provides expert practitioners to support any competency in any phase of the project life cycle, including: team building; planning and scheduling; program control analysis; systems integration support; risk management; and software management—in short, from formulation through implementation and evaluation. NASA teams of all sizes benefit from these customized consultations with expert practitioners.

Formal Development Programs

Since NASA practitioners report that 90% of learning takes place on the job, the Academy facilitates on-the-job learning experiences, including developmental assignments and learning from mentors, supervisors, and other senior personnel. Top performers are intrinsically motivated to seek out professional development opportunities—whether in the form of courses, work assignments, or mentoring relationships—simply because they see continuous learning as part of the job. The Academy encourages participants to work with their managers to identify appropriate on-the-job learning experiences that reinforce and supplement classroom learning.

Hands-On Project Experience (HOPE)

Project HOPE (Hands-On Project Experience) is a cooperative workforce development program sponsored by the NASA Academy of Program/Project and Engineering Leadership (APPEL) and the Science Mission Directorate (SMD). Project HOPE provides an opportunity for a team of early entry NASA managers and engineers to propose, design, develop, build, and launch a suborbital flight project over the course of a year. The purpose of the program is to enable practitioners in the early years of their careers to gain the knowledge and skills necessary to manage NASA's future flight projects. The Science Directorate at Langley Research Center manages the program. The Office of the Chief Engineer and SMD establish an annual budget, and participating centers are free to add funding. The Academy conducts an evaluation effort as well as develops a case study and articles about the learning that takes place over the course of the year.

Systems Engineering Leadership Development Program (SELDP)

The Systems Engineering Leadership Development Program (SELDP), an agency-wide leadership development program, has been designed for high-potential systems engineers who are expected to lead higher-level or more complex systems engineering efforts in the near future. This comprehensive year-long program provides development in the "art" of systems engineering through leadership assessment, training, coaching, and mentoring, as well as in the "science" of systems engineering through assignments outside the home center.

Developmental assignments are intended to expand the participant's systems engineering experience beyond his/her home center and area of technical expertise and to expose him/her to how systems engineering is practiced at other NASA centers. Participant selection involves identifying individuals who have proven technical/discipline capability and who have demonstrated key leadership capabilities and behaviors. The competitive process ensures that the most qualified individuals are selected for this opportunity at the right time in their careers when the learning will have the greatest impact. Individuals must be nominated by their Center Director and Center Engineering Director for this program. Visit http://www.nasa.gov/offices/oce/appel/seldp/index.html for more information.

How to Register for APPEL-Sponsored Programs

Please complete your self-registration for the Academy courses through the SATERN online approval process. The implementation of an agencywide standard process through one system for all courses helps to improve consistency and efficiency in training operations and administration. The self-registration process in SATERN replaces other nomination forms previously available. All employees requesting APPEL courses need to log in to SATERN to start the self-registration process.

Please note that an estimate of travel and per diem expenses must be provided by participants when registering for courses. Travel and per diem information is required for reporting to the Office of Personnel Management, and should be included in the comments section for review. If this information is not included, the request will be denied and the employee will be required to re-register.

- To view a step-by-step guide on how to register for courses, please visit the SATERN informational web site at https://saterninfo.nasa.gov/guides_aids.html.
- To access SATERN, please go to http://satern.nasa.gov.
- If you need further information on a course or regarding registration, please contact your center's APPEL Training Point of Contact (POC). For a complete list of POCs and their contact information, please go to http://www.nasa.gov/offices/oce/appel/curriculum/532.html

WHAT COURSES TO TAKE AND WHEN: A GUIDE TO PROFESSIONAL DEVELOPMENT PLANNING

What Courses to Take and When

LEVELS OF PROJECT LEADERSHIP			
The levels of project leadership are guideposts as to when during an individual's career a course can be taken. Individuals should attend courses as they see fit to enhance competencies within their current positions, or for future development requirements.			
Team Practitioners/ Technical Engineers	Subsystem Leads	Project Managers/Project Systems Engineers	Program Managers/Chief Engineers
CORE COURSES			
The core curriculum provides fundamental knowledge for NASA's technical workforce.			
• Foundations of Aerospace at NASA	• Project Management and Systems Engineering	• Advanced Project Management and Advanced Systems Engineering	• Executive (TBD)
IN-DEPTH COURSES			
These courses are intended to provide in-depth, detailed, and supplemental knowledge and skills for achieving current and future job requirements and augment the core curriculum.			
Program/Project Management			
Program and project management (P/PM) training courses are designed to promote the conceptual and practical use of modern P/PM theories and applications throughout all phases of the NASA project life cycle.			
• Beyond Scheduling Basics • NASA's Budgeting Process • Project Planning Analysis and Control • Risk Management • Understanding Project Scheduling	• Assessing Project Performance • Continuous Risk Mgmt • Orbital Debris Mitigation and Reentry Risk Mgmt** • Performance Based Statement of Work • Project Acquisition Workshop • Project Review Processes and Strategies • Scheduling and Cost Control	• Integrating Cost and Schedule • International Project Management* • Passing the PMP Examination • Strategic Thinking for Project Success	

*Course can be taken by anyone in a role that deals with international project management issues.

**Also listed under Engineering (same course).

Earned Value Management The Academy provides extensive training in earned value management (EVM) to ensure that NASA project practitioners understand the uses of this tool for measuring and assessing project performance.			
• EVM Overview • Beyond EVM Basics • Understanding EVM	• Advanced EVM Topics • Integrating EVM with Acquisition		
Communication and Leadership These courses are designed to help internalize the skills that help facilitate open and continuous communications with colleagues, develop personal leadership qualities, and improve negotiation skills.			
• Communicating Technical Issues • Negotiations • Team Membership • Technical Writing for the NASA Engineer • Workgroup Dynamics***	• Team Leadership • Project Management Leadership Lab	• Leading Complex Projects	*Consider taking agency leadership courses offered by OHCM.*

***KSC only. Please refer to http://www.nasa.gov/offices/oce/appel/curriculum/courses/appel_wgd.html.

Systems Engineering			
The Academy's systems engineering curriculum provides training in systems engineering processes and tools, and promotes experience-driven technical leadership development.			
• Fundamentals of Systems Engineering • Life Cycle, Processes, and Systems Engineering • Requirements Development and Management • Requirements Development and Management – Team • Understanding NPR 7123.1 Systems Engineering Processes and Requirements	• Concept Exploration and Systems Architecture • Decision Analysis • Developing and Implementing SEMP • Exploration and Space Operations • Mars Mission and System Design Lab • Space Launch Transportation Systems • Space Systems V&V • Science Mission Systems Design and Ops Course/ Lab • Transition, Product Delivery, and Mission Ops		
Engineering			
The Academy's engineering courses focus on engineering essentials, critical thinking, lessons learned, and space systems to strengthen NASA-specific engineering expertise and capabilities.			
• Essentials of Astronomy for Engineers • Introduction to Aeronautics • Introduction to Green Engineering • NASA Missions: Engineering Exploration	• Design for Manufacturability and Assembly • Earth, Moon, and Mars • Innovative Design for Engineering Applications • Orbital Debris Mitigation and Reentry Risk Mgmt* • Seven Axioms of Good Engineering • Space System Development: Lessons Learned		

*Also listed under Program/Project Management (same course).

Examples of Knowledge Sharing Activities These are only examples; each center should identify experiences specific to their needs.			
• Obtain a mentor • Attend a technical conference • Demonstrate working knowledge of agency policy documents • Join national and international affiliations or technical bodies (i.e., INCOSE, PMI)	• Write and present a technical paper • Attend the Masters Forum, PM Challenge, or other non-NASA conferences	• Write and propose a technical paper for possible presentation at a Masters Forum, PM Challenge or external NASA conference • Learn from case studies	• Become a mentor • Conduct storytelling sessions • Instruct or become a guest speaker at APPEL courses • Submit an article for possible publication in *ASK Magazine*

CURRICULUM

FOUNDATIONS OF AEROSPACE AT NASA (FOU)

AUDIENCE

This course is designed for all NASA employees to educate them about NASA's strategic direction, its missions, governance structures, technical guidelines, and mission directorate programs and projects as well as NASA's past, present and future.

GOAL

The goal of this two-week learning experience is to immerse participants into the meaning of working at NASA and the principles of technical excellence. This aerospace foundations course provides the big picture overview of NASA, its Governance model and operations. The NASA leadership and various technical experts will provide insights into the organization and inner-workings of the Agency.

LEARNING OUTCOMES

You will gain an understanding of the basics of NASA's aerospace mission and systems, as well as the fundamentals of aeronautics. You will better understand the NASA organization (including Center activities), key programs and projects, and the Agency's vision for exploration. You will explore the characteristics of effective teams and discover the value of effective technical communication and leadership. Additionally, you will be introduced to technical career development resources at NASA, particularly programs and activities sponsored by the Academy of Program/Project and Engineering Leadership.

LEARNING METHODS

Learning will be accomplished through the use of lectures, videos, animations, and group exercises. A special aspect of the course includes discussions and activities with NASA leadership (from Headquarters and the Centers), astronauts, and other noted NASA individuals. Learning activities include pre- and post-class assignments and reports.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Explain NASA's strategic goals and objectives as an Agency, including its mission, and governance model.
- Describe the "big picture" of NASA, the Agency, and how the infrastructure works.
- Describe the basics of NASA's space mission and systems, including aeronautics and astronautics concepts.
- Demonstrate effective technical communication skills and teamwork.
- Identify specific space exploration programs and projects and demonstrate the importance of space exploration to America.
- Explain the concept of systems thinking and associated trades.
- Explain trends in the space industry, space missions and systems.
- Explain the fundamentals of orbits, maneuvering in space, interplanetary travels and the space environment.
- Describe key aspects of payload and spacecraft design, launch systems, and space system operations.

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Agency Structure and Internal Goals; Communication/Decision Making; Team Dynamics; Aeronautics and Astronautics Concepts and Terminology; Aircraft Design Fundamentals; Trends in the Space Industry; Fundamentals of orbits, interplanetary travels and the space environment; overall Space system design and operations; basic aeronautics concepts; fundamentals of aircraft design; NASA PM&SE Policies and Procedures

I gained some **USEFUL INSIGHT** into each **MISSION DIRECTORATE,** the focus, and what factors **INFLUENCE** the **DECISIONS.**

ATTENDANCE

Enrollment and participation in this course is by Center or organization nomination only. Please contact your Center Training and Development Officers and APPEL Coordinators for more information on the nomination process.

PROJECT MANAGEMENT AND SYSTEMS ENGINEERING (PM&SE)

AUDIENCE

This course is designed for NASA project practitioners and systems engineers prior to or in the first year of entry into project, systems engineering or supervisory positions.

GOAL

This two-week course is intended to enhance proficiency in applying PM and SE processes/practices over the project life cycle. This course focuses on defining and implementing system projects and provides valuable insight for managing and leading project and technical teams.

LEARNING METHODS

Learning will be accomplished using lectures, individual and group activities, and case studies. Learning activities include pre- and post-class assignments and reports.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Explain the NASA project life cycle using PM and SE best practices and processes.
- Develop a project schedule and use the WBS to develop a network diagram.
- Identify contract types and understand contract management and procurement processes from start to finish.
- Apply the NASA paradigm to rank and prioritize risks.
- Describe EVM guidelines and perform technical and programmatic activities to control costs, schedule and technical content.

ATTENDANCE

Enrollment and participation in this course is by Center or organization nomination only. Please contact your Center Training and Development Officers and APPEL Coordinators for more information on the nomination process.

RECOMMENDED PREREQUISITES

Foundations of Aerospace at NASA, or equivalent knowledge.

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Requirements Development; Logical Decomposition; Design Solution; Technical Requirements Definition; Requirements Management; Stakeholder Expectation Definition and Management; Technical Planning; Product Integration; Product Verification; Product Validation; Product Transition; Operations; Resource Management; Contract Management; Acquisition Strategies and Procurement; Risk Management; Project Planning; Cost Estimating; Project Control; Project Review and Evaluation; Earned Value Management; NASA PM & SE Policies and Procedures

NOTES

This course is registered by the Project Management Institute (PMI) for 79 Professional Development Units (PDUs). PMI Course ID: PMSEA01

ADVANCED PROJECT MANAGEMENT AND ADVANCED SYSTEMS ENGINEERING (APM&ASE)

AUDIENCE

This course is designed as graduate-level seminar for experienced project managers (PMs) and systems engineers (SEs).

GOAL

This four-day course focuses on advanced concepts of project management and systems engineering and their integration in the management of all phases and facets of the project life cycle. This participant-driven course uses a case study approach to examine such topics as system architecting, performance, risk, cost, schedule, reliability and operability, as well as stakeholder management and acquisition strategies.

The structured facilitation provides the context that frames advanced project management and systems engineering concepts used to describe practices, approaches and issues. The participants will compare, differentiate, and discuss similarities, differences, and applications in order to draw conclusions on how to apply these concepts in their organization. This course equips you with the knowledge necessary to realize successful project solutions, leveraging the unique roles and responsibilities of the project managers and the systems engineers put forth in NPRs 7120.5D and 7123.1A.

LEARNING METHODS

Learning will be accomplished primarily through facilitated and structured class discussion on advanced systems engineering and project management topics, although introductory lectures on the key course topics will preface each of the sessions. Utilizing NASA and industry case studies, attendees then practice the 'how-to' of the principles through analyzing situations and applying concepts from the course to real project scenario exercises and illustrative examples. These practical exercises, complemented by the facilitated knowledge sharing that elicits senior level project experiences, provide opportunities to consider and apply new techniques and decision processes required in real world NASA project environments.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Manage the integration project management and systems engineering personnel functions to balance performance, risk, cost, schedule, reliability and operability through all life-cycle phases per NASA policy guidelines.
- Apply techniques for coping with multiple stakeholders, complex approval situations and teams drawn from across NASA.
- Manage the development of a system architecture compatible with the performance requirements and the organizations involved with that system, acceptable levels of risk and suitable for the NASA mission to be performed.
- Direct the identification of system functional boundaries including multiple interfaces, segmenting the architecture into functions and conducting functional analysis on all of the segments.
- Construct efficient acquisition strategies, lead their implementation, and monitor their effectiveness.

ATTENDANCE

Enrollment and participation in this course is by Center or organization nomination only. Please contact your Center Training and Development Officers and APPEL Coordinators for more information on the nomination process.

RECOMMENDED PREREQUISITES

Project Management and Systems Engineering (PM&SE) or equivalent knowledge

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

PM & SE Integration; Project Planning; Risk Management; Stakeholder Management; Project Control; Leadership; Communication and Decision Making; System Architecture; Acquisition Strategies and Management; System Design

NOTES

The American Council on Education (ACE) has recommended that 2 transferable graduate level credits be awarded for the successful completion of this course.

This course is registered by the Project Management Institute (PMI) for 39 Professional Development Units (PDUs). PMI Course ID: APMSE03

Project Management, Communication, and Leadership Courses

The Academy's program and project management training courses are designed to promote the conceptual and practical use of modern program/project management theories and applications throughout all phases of the NASA project life cycle.

ASSESSING PROJECT PERFORMANCE (APPEL-APP)

AUDIENCE

This course is designed for project managers, subsystem managers, and other project team members who are responsible for meeting project commitments and would benefit from understanding integrated project performance assessment techniques.

GOAL

This two-day course is designed to help participants manage and make informed decisions from the volumes of data about project performance such as earned value, risk matrices, critical path, slack, estimates to complete, cost variances, configuration changes, contract modifications, award fee scores, technical performance measures, and others.

LEARNING METHODS

Lectures and discussions are combined with case studies, demonstrations, and exercises to maximize the learning experience.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Recognize the importance of project performance assessment
- Apply performance assessment methodologies using existing project data
- Interpret the significance of the project performance assessment results
- More fully synthesize project performance data from multiple sources into a cohesive assessment of past, present and future performance of the project

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Budget and full cost management; tracking and trending of project performance.

NOTES

This course is registered by the Project Management Institute (PMI) for 15 Professional Development Units (PDUs). PMI Course ID: APP006

BEYOND SCHEDULING BASICS: ANALYSIS, CONTROL AND RESERVE PLANNING (APPEL-BSB)

AUDIENCE

This course is designed for project team members who are responsible for planning, controlling and analyzing cost, schedule and technical performance of an activity, project, or contract.

GOAL

This one-day course builds upon the foundational processes of activity definition, activity sequencing, activity duration estimating, schedule development, schedule status accounting and data maintenance, and schedule performance reporting by examining the more advanced topics of schedule analysis, schedule control (baseline revisions, re-planning, and workaround planning), and schedule reserve planning.

LEARNING METHODS

Lectures and discussions are combined with case studies, demonstrations, and exercises to maximize the learning experience.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Employ ways to assess when a project is likely to finish
- Assess if the schedule is realistic
- Appraise the significance of past schedule performance and trends
- Evaluate the effect of changes on the baseline and current operating schedules
- Assess the adequacy of schedule reserve and slack
- Identify risk in the schedule
- Recognize how to control the schedule (including methods to accelerate the schedule or get back on track if behind plan)
- Differentiate between schedule baselines, re-baselines, revisions, re-plans, and work-around plans

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Project control; tracking and trending of project performance

NOTES

This course is registered by the Project Management Institute (PMI) for 7 Professional Development Units (PDUs). PMI Course ID: BSB008

COMMUNICATING TECHNICAL ISSUES (APPEL-CTI)

AUDIENCE

This course is designed for NASA's technical workforce, including systems engineers and project personnel working on or leading project teams.

GOAL

This two-day workshop provides the foundation for communicating technical information to a varied audience and demonstrates effective methods and strategies for presenting technical issues.

SCHEDULE MARGIN and **PLANNING INSIGHTS** can be directly applied to my **GROUND OPERATIONS** planning **WORK.**

LEARNING METHODS

This course provides hands-on experience in effectively communicating complex, technical information to different audiences, both those familiar with and those unfamiliar with the topic. Individual and small-group learning exercises will help you develop key communications competencies. In a laboratory setting, participants will structure and conduct presentations/meetings with stakeholders and project team members and establish a set of effective e-mail practices to use within a project.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Describe a basic communications model and apply it to different settings where technical information is required
- Recognize the information and communications needs of diverse groups (e.g., project stakeholders, team members, review teams)
- Design and deliver technical communications using different media (e.g., meetings, presentations, e-mail).
- Present (in oral and written form) complex, technical material that is carefully tailored to specific audiences and that facilitates understanding
- Solicit feedback and information as you present technical concepts and reports

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Communication and decision making; stakeholder management

NOTES

This course is registered by the Project Management Institute (PMI) for 15 Professional Development Units (PDUs). PMI Course ID: CTI009

CONTINUOUS RISK MANAGEMENT (APPEL-CRM)

AUDIENCE

This course is designed for NASA's technical workforce, including systems engineers and project personnel developing the competencies required to succeed as a leader of a project team, functional team, or small project.

GOAL

This three-day course covers planning and control of risk factors; the recognition and reporting of all risk components such as technical, cost, schedule, safety, international traffic in arms regulations (ITAR), and environmental requirements; and application of methods and techniques to assess, mitigate, and balance risks at each level of the program/project.

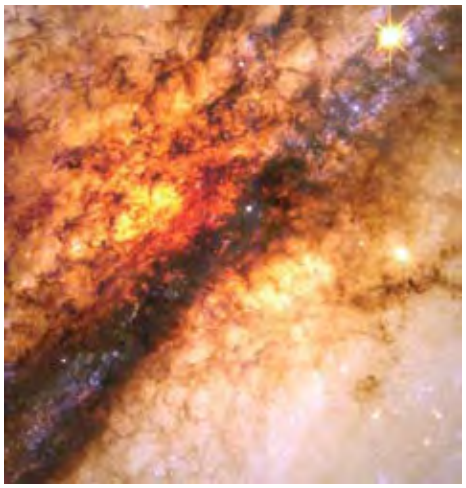
LEARNING METHODS

This course uses current NASA project examples known to the facilitators as well as ongoing risks identified by class participants to provide hands-on experiences in management of program/project risks. Multimedia presentations, lectures, interactive discussions and small team workgroups will enhance the learning experience.

SPECIFIC OBJECTIVES

The course is designed to integrate two complementary processes in the form of risk management: risk-informed decision making (RIDM), and continuous risk management (CRM). Upon completion of this course, participants will be able to:

- Apply risk analysis methods and techniques to develop specific mitigation strategies and actions
- Evaluate program/project decisions and identify appropriate risk alternatives for each decision
- Create an effective risk review process
- Assess the impact of specific risks to project objectives and define documentation and reporting characteristics.
- Evaluate whether qualitative and quantitative risk identification methods and techniques should be applied to program/project activities
- Define, document and describe the advantage, use, and application of database tools for the capture, tracking, and reporting of risks
- Formulate strategies to mitigate or eliminate risks, including a contingency plan



COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Technical risk management; stakeholder management

NOTES

This course is registered by the Project Management Institute (PMI) for 23 Professional Development Units (PDUs). PMI Course ID: CRM010

INTEGRATING COST AND SCHEDULE (APPEL-ICS)

AUDIENCE

This course is designed for experienced project managers who are already subsystem leads or managers of small projects and who are preparing to perform as project managers on more complex projects (multiple distinct subsystems, or other defined services, capabilities, or products) with associated interfaces.

GOAL

This two-day course is geared toward increasing project managers' proficiency in dealing with the cost and schedule aspects of project management.

LEARNING METHODS

Learning will take place through a series of lectures, discussions, exercises, case studies and demonstrations.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Recognize the importance of cost and schedule management to mission success
- Identify the various schedule communication tools and their implications
- Plan and manage within the realities of current federal budget environment
- Conduct Baseline and Reserve planning through range estimates

- Explain techniques to effectively communicate cost and schedule
- Discuss how to integrate cost and schedule with Earned Value Management (EVM)
- Illustrate a schedule problem that flight project teams might face and formulate possible work-around plans to solve it
- Formulate strategies for effectively dealing with complex inter-organizational conflicts
- Use new skills for successful budget justification.
- Assess project performance based on limited cost, schedule and EVM data
- Express insight into evaluating projected final cost of a project
- Communicate project performance status to senior management

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Project control; tracking and trending of project performance; budget and full cost management; communication and decision making

NOTES

This course is registered by the Project Management Institute (PMI) for 15 Professional Development Units (PDUs). PMI Course ID: ICS013

INTERNATIONAL PROJECT MANAGEMENT (APPEL-IPM)

AUDIENCE

This course is designed for project managers, systems managers, systems engineers and program managers who work on international projects.

GOAL

This five-day course provides project practitioners with an understanding of cultural challenges, legal concerns, and teaming issues that are likely to be encountered working with international partners. The course addresses two distinct facets of successful international project management: technical knowledge and cultural understanding.

> Very **GOOD SESSION** explaining intricacies of **INTERNATIONAL CUSTOMS** and of **UNDERSTANDING** and **RESPECTING** customs…

LEARNING METHODS

Course materials and discussions provide insights into the characteristics of international teaming that have the potential to make or break a project. The course format features lectures, small group discussion, hands-on practical exercises, and case studies. Instructors are successful NASA project managers from the international arena who discuss their experiences with participants, shedding light on multinational project traps and how to avoid them. Guest lecturers include content experts with international experience and, when available, relevant embassy personnel.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Apply experiential and theoretical knowledge of cultural awareness and leadership
- Manage or support a project that interacts with international partners
- Successfully manage projects involving international elements
- Practice advocacy, partnering, and the "softer" side of cross-cultural relations to be effective in the international arena
- Recognize the cultural understanding necessary to manage or participate at any level of an international project team

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

International standards and political implications

NOTES

The American Council on Education (ACE) has recommended that 3 transferable graduate level credits be awarded for the successful completion of this course.

This course is registered by the Project Management Institute (PMI) for 40 Professional Development Units (PDUs). PMI Course ID: IPM014

LEADING COMPLEX PROJECTS (APPEL-LCP)

AUDIENCE

This course is designed for experienced project managers who are subsystem leads or managers of small projects and are preparing to perform as project managers of more complex projects (multiple distinct subsystems, or other defined services, capabilities, or products) with associated interfaces.

GOAL

This three-day course provides participants with key project management concepts, tools, and techniques used to manage complex projects successfully. It also provides insights and tools to measure project complexity and adopt the best techniques for ensuring control of a project and all of its associated elements.

LEARNING METHODS

This course is a progressive, integrated case study that enables participants to determine the true level of project complexity, and to lead a project team from a new perspective.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Clearly recognize how to address variables involved in dealing with complex projects
- Master techniques for accurate work estimating and risk analysis in complex situations
- Create a plan that provides the right level of control and flexibility for success in complex projects

I **LEARNED** how to **IDENTIFY** complex projects; how to handle **COMPLEXITY**; how to **GAUGE** a project's complexity; and **HOW TO SIMPLIFY** large **COMPLEX PROJECTS.**

- Integrate strategic planning techniques to meet NASA requirements for complex projects
- Recognize techniques for dealing with multiple stakeholders, complex approval situations and teams drawn from across the agency's organizational boundaries

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Risk management; project planning; stakeholder management; tracking and trending of project performance; project control; leadership; communication and decision making

NOTES

The American Council on Education (ACE) has recommended that 1 transferable graduate level credit be awarded for the successful completion of this course.

This course is registered by the Project Management Institute (PMI) for 23 Professional Development Units (PDUs). PMI Course ID: LCP015

NASA'S BUDGETING PROCESS (APPEL-NBP)

AUDIENCE

This course is designed for project team members interested in an introductory course in NASA budget development.

GOAL

This one-day course describes the steps in the U.S. government's budgeting process while providing a framework for understanding how NASA project budget requests fit into the agency's overall budget. The course provides a survey of proper contingency and reserve planning to the budgeting process while reinforcing the importance of carefully tracking costs and obligations against the budget plan and the reasons for variances.

LEARNING METHODS

Lectures, discussions, and group exercises will present key concepts regarding the budget process.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Discuss the federal budget process
- Recognize how project budget requests fit into NASA's budget picture
- Discuss the team member's role in developing the Program

Operating Plan (POP)

- Describe the processes for cost estimating
- Identify significant needs and issues in preparing budgets
- Express the importance of tracking costs and obligations against the budget plan and the reasons for the variances

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Budget and full cost management; agency structure and internal goals; NASA project management procedures and guidelines

NOTES

This course is registered by the Project Management Institute (PMI) for 7 Professional Development Units (PDUs). PMI Course ID: NBP016

NEGOTIATIONS (APPEL-NG)

AUDIENCE

This course is designed for members of NASA's technical workforce, including systems engineers and project personnel, who seek to develop the competencies required to succeed as a leader of a project team, functional team, or small project.

GOAL

This two-day workshop identifies and develops the negotiating and bargaining skills necessary to successfully execute a win-win negotiation. Thorough instruction is provided on how to develop negotiating skills that promote effective leadership.

LEARNING METHODS

This highly interactive workshop uses a variety of instructional methods. Methods include tailored case studies, interactive facilitation, Q&A sessions, and other nontraditional techniques. Participants will take part in increasingly demanding negotiations and use impact and influence skills to persuade others to agree in both one-on-one and team exercises.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Construct creative, mutually satisfactory "win-win" solutions
- Analyze available negotiating tactics and select strategies that can move the situation to your advantage
- Establish and maintain a positive negotiating climate and effectively handle emotional situations
- Overcome impasses by structuring creative options.
- Set desired outcomes, goals, bottom line targets, and alternative outcomes and options
- Relate the difference between positions, interests, and fears
- Overcome natural reluctance to negotiate, and reduce stress levels in the negotiation process
- Use creativity and value-based negotiating to help achieve successful closure
- Recognize how to manage ego and trust issues
- Effectively manage team/staff negotiating situations

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Acquisitions management; contract management; leadership; team dynamics and management

NOTES

This course is registered by the Project Management Institute (PMI) for 15 Professional Development Units (PDUs). PMI Course ID: NEG018

ORBITAL DEBRIS MITIGATION AND REENTRY RISK MANAGEMENT (APPEL-ODM)

AUDIENCE

This course is designed for NASA project practitioners, mission members, engineers, scientists, and other project support staff who are involved in spacecraft design and operations and interested in orbital debris issues and employing mitigation approaches, including "design for demise."

GOAL

This two-day course introduces participants to orbital debris environment characterization and mitigation, including characterization and future growth of the orbital debris environment; collision risks; and orbital debris mitigation policies, processes, requirements, and standards. It also explains reentry risks and design for demise methodology, including the origin and nature of NASA Human Casualty Reentry Risk assessments and criterion; overviews and applications of NASA Debris Assessment Software (DAS) and Object Reentry Survival Analysis Tool (ORSAT); design for demise objectives and experience; and demonstration of DAS reentry risk assessment.

LEARNING METHODS

Learning will be accomplished through lectures, specialized software tool demonstrations, and mini-case studies of real world examples.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Identify the characteristics of the orbital debris environment and its sources.
- Describe various measurements in low-Earth orbit (LEO), medium-Earth orbit (MEO), and geosynchronous orbit (GEO), and explain orbital debris modeling methods, and collision risk probabilities and assessments.
- Describe orbital debris mitigation policies at the agency, national, and international levels.
- Explain the nature of NASA's Human Casualty Reentry Risk Assessments and Criterion.
- Describe the NASA Reentry Risk Evaluation Process, per NASA Standard 8719.14 requirements.
- Explain the benefits of DAS and ORSAT reentry assessment tools.
- Define the objectives for "design for demise" philosophy.
- Identify implementation design for demise strategies on specific NASA missions, including GPM, GLAST, RBSP, and Commercial Orbital Transportation Services (COTS).

For a **RELIABILITY ENGINEER** responsibility ends with the completion of an **ORBIT OPERATION**, but with this course, I **REALIZED** that there is another part of the **MISSION** that should be evaluated. Reliability should **EVALUATE RISKS** after the **END** of a **MISSION** phase.

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Orbital debris environment classifications; reentry risk assessments; design for demise; NASA orbital debris mitigation policies and requirements; collision risk probabilities and assessments

PASSING THE PROJECT MANAGEMENT PROFESSIONAL EXAM (APPEL-PMP)

AUDIENCE

This course is designed for individuals seeking the Project Management Professional certification.

GOAL

This 3.5-day course will acquaint the student with the 44 Project Management Institute (PMI) processes, their inputs, tools, techniques and outputs that comprise approximately 80% of the Project Management Professional (PMP) exam. It will also give the student the opportunity to become acquainted with the significant amount of material on professional responsibility and human resources that is not covered in PMI's Project Management Body of Knowledge (PMBOK).

LEARNING METHODS

The large amount of material to be absorbed requires that the material be presented in a variety of ways. In addition to conventional lecture, the participants will act in skits, participate in games, see videos and hear effective jingles, poems, and use other mnemonic, interactive learning techniques. Participants will take notes using color-coded pens that will match a large colored chart they receive. The presentation will address all learning styles.

QUALIFICATIONS FOR THIS COURSE

Interested students are encouraged to contact the instructor (Chris Bart) in advance to determine if they qualify to register for and attend this course.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be eligible to:

- Be guided personally through the application process for the Project Management Institute's PMP examination
- Be counseled in advance to ensure that they are qualified to sit for the 200-question, four-hour PMP exam

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Project conceptualization; resource management; project implementation; delivery, operation, and closeout; program control and evaluation; human capital management; safety and mission assurance; professional and leadership development; knowledge management

PERFORMANCE-BASED STATEMENT OF WORK (APPEL-PBSOW)

AUDIENCE

This course is designed for NASA's technical workforce, including systems engineers and project personnel developing the competencies required to succeed as a leader of a project team, functional team, or small project.

GOAL

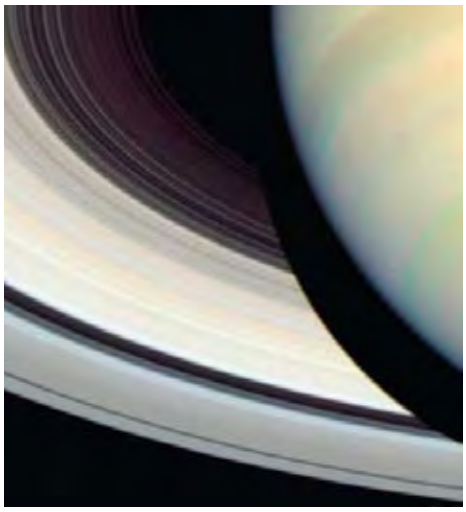
This two-day course will show you how to write an effective Performance-Based Statement of Work (PBSOW). You will understand what is meant by performance-based contracting and discover the advantages of this contract methodology.

LEARNING METHODS

Learning is accomplished through instructor-lead sessions using slides and flip charts. Students follow along using a detailed course package that is provided as part of the seminar. Students are encouraged to provide examples and "war stories" from their experiences.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:



- Define and describe performance-based contracts.
- Describe the advantages of PBSOW as opposed to a level-of-effort (LOE) statement of work
- Identify the characteristics of both good and bad performance-based contracts
- Analyze a given situation to establish the necessary requirements
- Write SOW requirements that are clear and measurable
- Demonstrate how to give contractors flexibility and authority while still holding them responsible

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Acquisition management

NOTES

This course is registered by the Project Management Institute (PMI) for 15 Professional Development Units (PDUs). PMI Course ID: S20008

PROJECT ACQUISITION WORKSHOP (APPEL-PAW)

AUDIENCE

This course is designed for NASA's technical workforce, including project managers, subsystem leads, resource managers, contracting officers' technical representatives, and technical engineers who must deal with project-related acquisitions and procurements.

GOAL

This two and a half day course provides a basic understanding of the NASA acquisition/procurement process across the complete project life cycle, from agency strategic planning to contract management and project completion. This course will help participants figure out the optimal acquisition/procurement strategy, learn how to get contracts awarded, solve problems during contract performance, understand their roles and responsibilities as members of a project's acquisition team, work more effectively with contracting officers, and enable them to do a more effective job acquiring whatever their projects need to succeed.

LEARNING METHODS

The learning methods include lectures, discussions, group exercises (both large and small), lessons learned, and war stories. The course is designed around a twelve-part case study, based on a theoretical NASA flight project that illustrates all aspects of project acquisition. The lectures and examples are all derived from contracts associated with a variety of NASA projects.

SPECIFIC OBJECTIVES

Upon completion of the course, participants will be able to:

- Define, develop, explain, propose, and implement acquisition strategy
- Analyze and translate the confusing world of procurement laws, regulations, and policies, recognize and apply the concept of "contract scope," and operate more effectively with contracting officers
- Plan for and implement project-related acquisitions, selecting the optimal procurement strategy and the type of contract most appropriate for the project
- Define and identify the relation between project technical requirements and the acquisition process
- Plan, organize, and manage the contract solicitation, evaluation, and selection processes
- Establish and manage a project acquisition team, including the roles of COTRs (contracting officer's technical representative), project managers (PMs), and contracting officers (COs), and monitor and evaluate contractor progress
- Identify, analyze, and solve the numerous problems that inevitably occur during contract performance

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Acquisition management; contract management

NOTES

The American Council on Education (ACE) has recommended that 1 transferable graduate level credit be awarded for the successful completion of this course.

This course is registered by the Project Management Institute (PMI) for 20 Professional Development Units (PDUs). PMI Course ID: APPEL–PAW

I have been **WORKING** on a **MAJOR PROJECT** for the past three years. There have been **NUMEROUS** times that I **DIDN'T UNDERSTAND** why something was being **DONE** a certain way, but have always been told **IT'S THE CONTRACT.** This class has **HELPED ME UNDERSTAND** that contract better.

PROJECT MANAGEMENT LEADERSHIP LAB (APPEL-PM-LAB)

AUDIENCE

This course is designed for NASA's technical workforce, including systems engineers and project personnel who seek to develop the competencies required to succeed as a leader of a project team, functional team, or small project.

GOAL

This four and a half-day course is an intensive experience aimed at building capabilities needed to achieve project team objectives and to synthesize the project management practices learned through previous practice and study. This laboratory provides a unique opportunity to identify, understand, and practice effective leadership behaviors in a project team setting.

LEARNING METHODS

The Project Leadership Lab is a highly interactive experiential program design. Developed from more than thirty years of applied research and continuous user input and innovation, the program is anchored by a complex computer simulation exploring a project launch—employing multiple decision tree scenarios that activate dynamic variations and realistic outcomes. As part of a small team, participants are responsible for implementing a computer-simulated project. Participant teams collectively confront and resolve an array of problems associated with tasks, vendors, consultants, time, quality, customer interactions, and staff with varying personalities, skills and experience.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Lead in ambiguous, complex environments
- Develop adaptive leadership skills: recognizing when to focus on technical versus adaptive problems
- Create defensible, flexible plans.
- Employ effective leadership techniques and improve interpersonal effectiveness.
- Manage risks
- Identify complex project trade-off decisions.
- Lead and improve project team performance.

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Project proposal; requirements development; project planning; cost estimating; risk management; budget and full cost management; systems engineering; contract management; project control; team dynamics and management; mentoring and coaching; leadership

NOTES

The American Council on Education (ACE) has recommended that 3 transferable graduate level credits be awarded for the successful completion of this course.

This course is registered by the Project Management Institute (PMI) for 31 Professional Development Units (PDUs). PMI Course ID: PMLAB19

I **GAINED INSIGHT** into the **NUANCES** and **INTRICACIES** of managing the **PEOPLE SIDE** of a project while **MAINTAINING** focus on cost/schedule, and the **IMPORTANCE** of taking **TIME TO LISTEN** to people and **MATCH SKILLS** appropriately.

PROJECT PLANNING ANALYSIS AND CONTROL (APPEL-PPAC)

AUDIENCE

This course is designed for NASA's new engineers ("fresh-outs").

GOAL

This five-day course offers a foundation in program planning, analysis, and control, and provides intensive instruction in project management fundamentals across the entire project life cycle. Course content covers the areas of technical integration of project elements, design and discipline functions, and their associated interactions to balance performance, cost, schedule, reliability, and operability. Proven strategies and practical tools for planning, executing, and controlling a variety of projects are presented.

LEARNING METHODS

Individual and small-group learning exercises will help participants master key theories, concepts and practices and put this knowledge to work in the classroom through a comprehensive case study and other practical learning activities.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Define a project, its objectives, and measurement criteria for success
- Estimate project schedules, costs, and resources using a variety of proven methods such as Earned Value Management
- Build a work breakdown structure of project tasks
- Define a network diagram and calculate the project schedule using PERT/Critical Path Method (CPM)
- Describe project risk identification, risk assessment, and risk mitigation strategies
- Close out a project in a systematic, comprehensive manner

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Budget and full cost management; project control; requirements development; project planning; risk management; project review processes and strategies

NOTES

This course is registered by the Project Management Institute (PMI) for 33.5 Professional Development Units (PDUs). PMI Course ID: FOU150

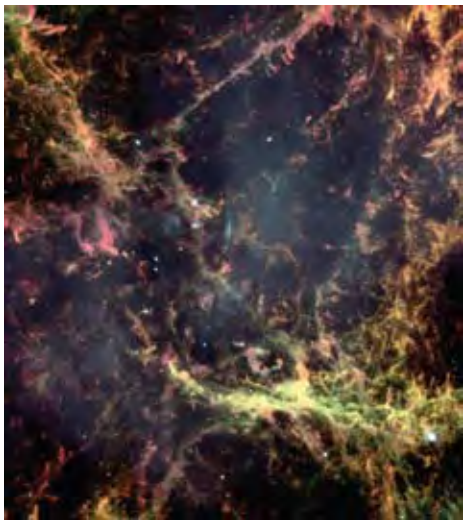
PROJECT REVIEW PROCESSES AND STRATEGIES (APPEL-PRPS)

AUDIENCE

This course is designed for experienced project and program managers, subsystem leads, other project team members and review board members, including Standing Review Board (SRB) participants.

GOAL

This learning activity is intended to demonstrate the planning process, content and techniques necessary to conduct a credible project review or



to serve as an effective review board member. It provides exposure to NASA standards, success criteria, lessons learned, tools and experiences for overall project review activities. This course is conducted in two parts: a one-day classroom lecture and exercise activity, followed by coached participation in an actual NASA program or project review that may require up to four days of activity.

LEARNING METHODS

This course provides a hands-on program or project review experience under the guidance of a project review coach. Lectures, small group exercises, and interaction with current project teams and review panels amplify the key aspects of the learning activity. Participants will serve as a "shadow review team at an actual NASA review, ask question, write Requests for Action (RFAs) and prepare and present an "outbrief" to program and/or project leaders, and compare their findings and recommendations with those of the formal review board.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Aid or lead the planning, preparation and presentation of a formal NASA review
- Serve as an effective chair or member of an SRB or other review board
- Prepare and present appropriate findings and recommendations to the program and/or project leaders following a review
- Create a list of lessons learned related to project review activity

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Project review and evaluation

NOTES

This course is registered by the Project Management Institute (PMI) for 32 Professional Development Units (PDUs). PMI Course ID: PRPS21

RISK MANAGEMENT (APPEL-RM)

AUDIENCE

This course is designed for NASA's technical workforce, including systems engineers and project personnel who seek to develop the competencies required to succeed as a leader of a project team, functional team, or small project.

GOAL

This one-day course enhances knowledge of NASA's approach to managing risk, and demonstrates the impact risks have on meeting program and project objectives. It provides practical knowledge on how to identify risks before problems arise, and develops the relationship between decisions and risk. The course also includes discussions on how to develop risk statements, and describes potential mitigation options.

LEARNING METHODS

Multimedia presentations, lectures, interactive discussions, use of current program/project examples, and case studies will enhance your learning of risk management.

SPECIFIC OBJECTIVES

The course is designed to integrate two complementary risk management processes: risk-informed decision making (RIDM) and continuous risk management (CRM).

Upon completion of this course, participants will be able to:

- Define NASA's risk management process
- Apply the NASA paradigm to rank and prioritize risks
- Identify the sources of risks and the issues and concerns that lead to risks
- Explain the relationships between project decisions and project risks
- Explain individual roles and responsibilities for identification and management of risks
- Use various tools and techniques for identifying, documenting, and communicating risks
- Discuss the relationship between risk magnitude and individual perspective on the organization
- Explain trending and tracking approaches and the use of metrics
- Apply the NASA risk management process
- Write acceptable statements of risks and mitigation plans

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Technical risk management; risk management

NOTES

This course is registered by the Project Management Institute (PMI) for 7 Professional Development Units (PDUs). PMI Course ID: RM022

SCHEDULING AND COST CONTROL (APPEL-SCC)

AUDIENCE

This course is designed for NASA's technical workforce, including systems engineers and project personnel who seek to develop the competencies required to succeed as a leader of a project team, functional team, or small project.

GOAL

This four-day course focuses on managing project constraints including limits on time, human resources, materials, budget, and specifications. It also helps participants to develop effective measures for scheduling and controlling projects as they put the tools of project management to work.

LEARNING METHODS

Participants will get hands-on experiences practicing skills in building project requirements and the work breakdown structure. Individual and small-group exercises feature scenarios that hone competencies and skills, and a comprehensive tool kit provides practical field guidance.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Identify documentation needed to provide inputs to scheduling and cost control activities
- Use the work breakdown structure to develop a network diagram
- Calculate schedules using PERT/ Critical Path Method (CPM)
- Identify, assign, and tabulate resource requirements
- Predict costs and work time using specific levels and estimate types
- Plan for contingencies and anticipate variations
- Estimate future project performance based on historical data
- Monitor changes and close out projects on time

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Project planning; cost estimating; project control; project review and evaluation; budget and full cost management; NASA project management procedures and guidelines

NOTES

This course is registered by the Project Management Institute (PMI) for 31 Professional Development Units (PDUs). PMI Course ID: SCC023

STRATEGIC THINKING FOR PROJECT SUCCESS (APPEL-STPS)

AUDIENCE

This course is designed for experienced project and program managers, chief engineers, lead and senior systems engineers, and business group leaders.

GOAL

This three day course introduces concepts and methods for using strategic thinking as a logical foundation upon which to shape project definition and management.

STRATEGIC THINKING is important at **ALL LEVELS** of the agency. Clear **UNDERSTANDING** of stakeholders, interdependencies, and R&R are **VITAL TO PROJECT SUCCESS.** I learned how to **USE** "strategic thinking" as part of my **DAY-TO-DAY ACTIVITIES.**

LEARNING METHODS

In addition to lecture, relevant case studies and class dialog, the course uses the participants' experiences to practice hands-on strategy development.

SPECIFIC OBJECTIVES

Upon completion of this course,

participants will be able to:

- Explain the elements of strategy
- Illustrate systems thinking using a SystemiGram®
- Analyze project current reality to determine contribution to strategic objectives
- Create a project vision statement that focuses project strategic thinking
- Define Key Performance Parameters tied to the strategic objectives
- Interpret organizational dynamics in a strategic context
- Create a strategic decision model using systems thinking
- Identify and implement relevant performance guideposts
- Evaluate project outcomes based on strategic performance
- Evaluate a project for possible termination when it will no longer achieve its strategic objectives

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Strategic thinking; systems thinking

NOTES

This course is registered by the Project Management Institute (PMI) for 24 Professional Development Units (PDUs). PMI Course ID: APPEL – STPS.

TEAM LEADERSHIP (APPEL-TL)

AUDIENCE

This course is designed for NASA's technical and administrative workforce, including systems engineers and project personnel who seek to develop the competencies required to succeed as a leader of a project team, functional team, or small project.

GOAL

This three-day workshop is aimed at building capabilities for managing and facilitating team processes necessary to achieve successful team performance. Concepts, processes, and practices for developing and managing superior teams are shared, and opportunities to practice and sharpen team leadership skills and competencies are part of the course content.

LEARNING METHODS

This workshop provides a venue for learning new concepts and for sharing successful and unsuccessful strategies for leading teams. Role-playing, and small group activities reinforce learning. Lecture and both small and large group discussions allow participants to share experiences and benefit from the experiences of others.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Distinguish between leadership and management functions within project teams
- Adjust leadership style to meet the demands and requirements of different situations and groups
- Define and implement open and integrated communication approaches within and between teams to improve the interaction of the team members, increase buy-in, and enhance performance.
- Build a cohesive team and establish common standards for performance and quality
- Motivate team members to pull together to accomplish goals
- Systematically solve problems and resolve conflicts within the team
- Ensure that agreed-upon plans are implemented
- Capture and apply lessons learned and best practices

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Team dynamics and management; mentoring and coaching; communication and decision-making

NOTES

This course is registered by the Project Management Institute (PMI) for 19 Professional Development Units (PDUs). PMI Course ID: TL0024

TEAM MEMBERSHIP (APPEL-TM)

AUDIENCE

This course is designed for NASA's new engineers/fresh-outs.

GOAL

This two-day workshop provides information on team dynamics, processes, roles/responsibilities, and other practical information for working effectively within a team environment. You will learn the strategies of how to be an effective member of a team and have opportunities to put these strategies into practice.

LEARNING METHODS

This course combines lectures and discussions to present the key concepts and proven practices that increase team collaboration. Individual and small-group learning exercises are used. Additionally, you will put this knowledge to work by participating in role-playing activities and other practical and stimulating learning experiences.

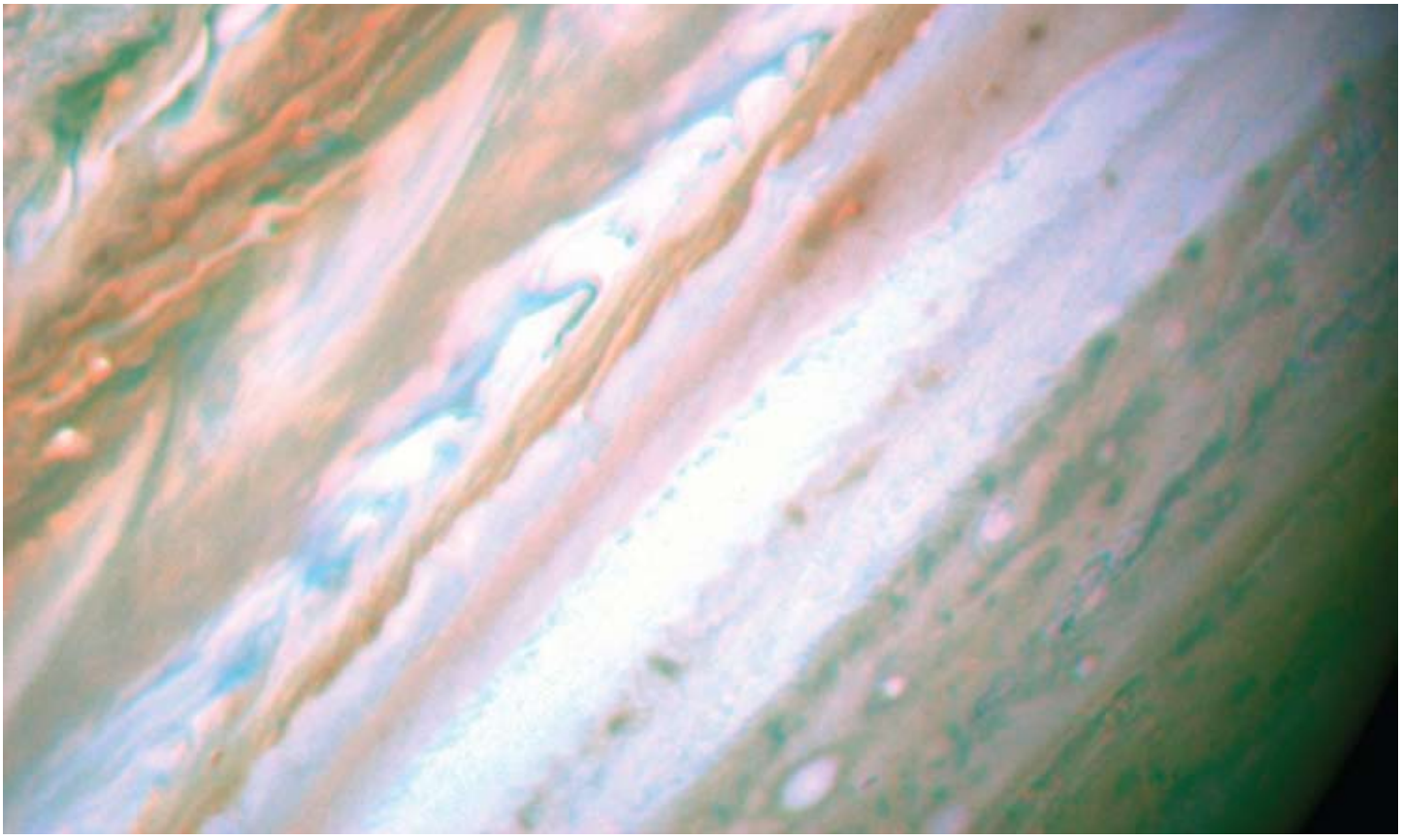
SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Recognize the importance of teamwork and participating in team activities at NASA
- Define and describe different roles and responsibilities of team members on a project team and how they impact team performance
- Identify and practice the characteristics of a superior NASA project team
- Use an understanding of group dynamics to be an effective NASA team member
- Apply team processes including collaborative decision-making, problem-solving methods, and conflict resolution approaches within or among teams
- Appreciate being open to diverse viewpoints to achieve team success

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Collaboration skills; team dynamics



TECHNICAL WRITING FOR ENGINEERS (APPEL-TW)

AUDIENCE

This course is designed for NASA's new and experienced engineers.

GOAL

This one-day workshop provides intensive instruction in technical writing to assist participants in improving technical communication skills, enabling them to effectively communicate technical/project information to different audiences.

LEARNING METHODS

Lectures and discussions will present key theories, concepts, and proven practices related to technical writing. Participants will take part in individual and small-group learning exercises to help develop skills and competencies. Participants will also put this knowledge to work by writing technical/project reports such as technical assessments, technical evaluations, and work-in-progress status reports.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Identify and explain the purpose of different types of technical reports
- Recognize specific components and formats of technical reports
- Analyze the audience
- Organize and structure a technical report
- Write effective headings, factual information/detail, and technical content
- Create clear figures/tables
- Recognize and avoid the common pitfalls of writing technical reports

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Communication and decision making; stakeholder management

ALMOST EVERYTHING covered **WILL** apply to some **ASPECT** of my **JOB.**

UNDERSTANDING PROJECT SCHEDULING (APPEL-UPS)

AUDIENCE

This course is designed for project team members who are responsible for planning, controlling and analyzing cost, schedule and technical performance of an activity, project, or contract.

GOAL

This one-day provides a foundation in how to develop, update and maintain a project schedule, and includes an overview of the key steps involved, including: activity definition, activity sequencing, activity duration estimating, schedule development, schedule status accounting and data maintenance, and schedule performance reporting.

LEARNING METHODS

Lectures and discussions are combined with case studies, demonstrations, and exercises to maximize the learning experience.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Discuss the purpose and benefits of the project schedule
- Recognize basic scheduling concepts and terminology
- Illustrate how to identify activities, define project logic, estimate activity duration, and calculate "early" and "late" start and finish dates for the project's activities to establish the schedule baseline
- Explain the significance of the critical path, total slack and schedule reserve
- Recognize various schedule reports and formats

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Project control

NOTES

This course is registered by the Project Management Institute (PMI) for 7 Professional Development Units (PDUs). PMI Course ID: UPS26

Project Management: Earned Value Management (EVM) Courses

Developed and taught by NASA-experienced EVM practitioners for NASA program and project teams, the EVM curriculum provides a framework for understanding this dynamic integrated project management methodology. The courses are recommended to be taken in the order listed below.

EARNED VALUE MANAGEMENT OVERVIEW (APPEL-EVMO)

AUDIENCE

This course is designed for project team members who need a top-level understanding of Earned Value Management concepts.

GOAL

This six-hour course will provide a high-level understanding of Earned Value Management (EVM) concepts as well as techniques for analyzing EVM data.

LEARNING METHODS

Lectures, discussions, case studies, and group exercises will present key concepts regarding the EVM process.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Recognize basic EVM concepts and terminology, and know how to interpret EVM reports and graphs
- Employ the governing requirements for EVM on NASA projects
- Recognize how to use performance indices and factors to calculate estimates of the final cost

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Budget and full cost management

NOTES

This course is registered by the Project Management Institute (PMI) for 7 Professional Development Units (PDUs). PMI Course ID: EVM012

UNDERSTANDING EARNED VALUE MANAGEMENT (APPEL-UEVM)

AUDIENCE

This course is designed for project team members who are responsible for planning, controlling, and analyzing cost, schedule and technical performance of an activity, project, or contract.

GOAL

This two-day course will provide an understanding of how to work with Earned Value Management (EVM) by establishing the Performance Measurement Baseline (PMB), assessing earned value, analyzing cost and schedule variances, and determining an Estimate at Completion (EAC) of the project's or contract's final cost and schedule.

LEARNING METHODS

Lectures, discussions, case studies, demonstrations, and group exercises will be used to present key concepts regarding the EVM process.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Recognize basic EVM concepts and terminology, and know how to create an EVM baseline
- Use EVM data to forecast the project's or contract's final cost at completion
- Create work packages using generally accepted earned value methods for discrete effort, apportioned effort, and level of effort
- Measure earned value at the work package level
- Recognize the principles involved in establishing a PMB, including: the role of WBS in defining scope; the value of developing a responsibility assignment matrix; the importance of the integrated master schedule; and the significance of tying the budget to the schedule with the WBS
- Recognize the significance of variances from the baseline

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Budget and full cost management

NOTES

This course is registered by the Project Management Institute (PMI) for 15 Professional Development Units (PDUs). PMI Course ID: UEVM25

BEYOND EARNED VALUE MANAGEMENT BASICS: BASELINE CONTROL, MANAGEMENT RESERVE AND PERFORMANCE INDICATORS (APPEL-BEVMB)

AUDIENCE

This course is designed for project team members who are responsible for the cost, schedule, and technical performance of project work scope.

GOAL

This two-day course will provide an understanding of how to manage baseline changes, control management reserve, and analyze performance indicators and flags that build upon the basic understanding of the Performance Measurement Baseline (PMB), cost and schedule variances and indices, and Estimate at Completion (EAC).

LEARNING METHODS

Lectures, case studies, discussion, demonstrations, and exercises will present key concepts regarding the EVM process.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Express how to manage changes to the Performance Measurement Baseline
- Describe how to make decisions about management reserve and schedule margin usage
- Calculate independent estimates at completion based on historical performance
- Recognize and respond to warning signs from a contractor's EVM data
- Recognize how common EVM analysis traps could compromise effective decision making
- Formulate pertinent EVM metrics and reporting for senior management

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Budget and full cost management; project control

NOTES

This course is registered by the Project Management Institute (PMI) for 15 Professional Development Units (PDUs). PMI Course ID: BEVMB

ADVANCED EARNED VALUE MANAGEMENT TOPICS: RECOGNIZING EVM AND SCHEDULE GAMING, ABUSE AND DATA MANIPULATION (APPEL-AEVMT)

AUDIENCE

This course is designed for project managers who are responsible for reviewing the cost, schedule and technical performance reporting of suppliers, contractors and partners.

GOAL

This one-day course provides an understanding of gaming, abuse and manipulation of Earned Value Management (EVM) and schedule management data, building upon an intermediate understanding of EVM and scheduling.

LEARNING METHODS

Lectures, examples and group discussions will present key concepts regarding advanced EVM topics.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Identify irregularities in EVM and schedule data
- Interface in an informed manner with suppliers, contractors and partners about potentially faulty performance reporting
- Formulate action plans to correct erroneous reporting
- Explain the role of EVM in contractors' performance evaluation and award fee process
- Formulate strategies to build a good EVM working relationship between the government and its contractor(s)

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Budget and full cost management

NOTES

This course is registered by the Project Management Institute (PMI) for 7 Professional Development Units (PDUs). PMI Course ID: AEVMT

INTEGRATING EARNED VALUE MANAGEMENT WITH ACQUISITION (APPEL-IEVMA)

AUDIENCE

This course is designed for project team members and contracting officers who use Earned Value Management (EVM) to monitor the cost, schedule, and technical performance of major contractors responsible for large development contracts.

GOAL

This half-day course provides a high-level understanding of Earned Value Management (EVM) concepts, and the effective integration of EVM with project management and acquisition.

LEARNING METHODS

Learning is accomplished through lectures, case studies, discussions, and group exercises.

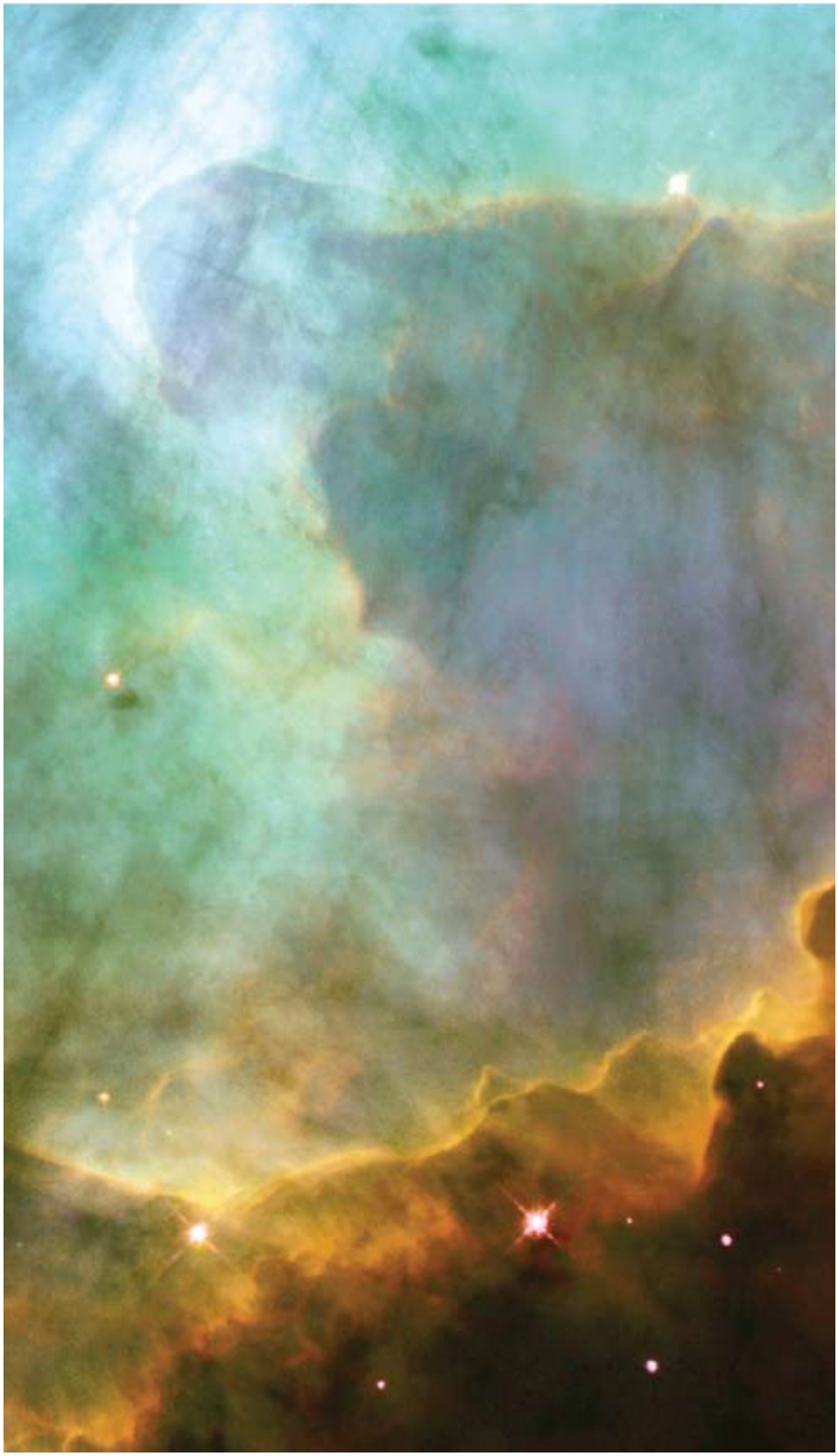
SPECIFIC OBJECTIVES

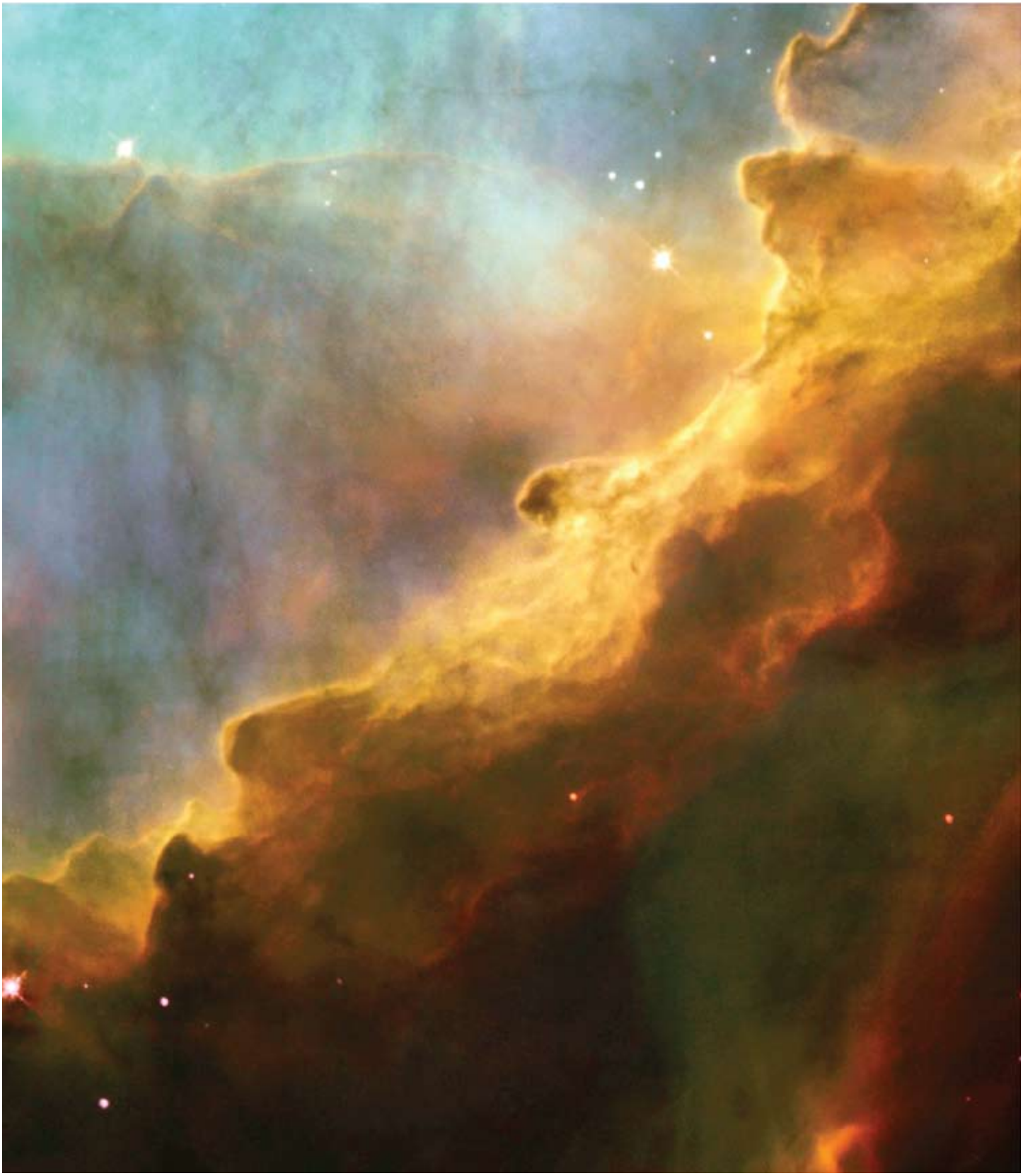
Upon completion of this course, participants will be able to:

- Discuss basic EVM concepts and terminology
- Recognize what acquisition mistakes to avoid that would otherwise hinder EVM effectiveness
- Recognize how to incorporate EVM into acquisition strategy and contract administration.

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Budget and full cost management; acquisition management; contract management





Systems Engineering Courses

The Academy's systems engineering curriculum provides training in systems engineering processes and tools and promotes experience-driven technical leadership development.

CONCEPT EXPLORATION AND SYSTEM ARCHITECTING (APPEL-CESA)

AUDIENCE

This course is designed for NASA's technical workforce, including systems engineers and project personnel.

GOAL

This four-and-a-half-day workshop introduces participants to the primary processes and tools for successfully performing up-front system engineering analysis. Participants learn how to define proper system scope, acceptance criteria, create context diagrams and develop use case scenarios, and synthesize a first level logical architecture for the system to help meet customer objectives, requirements and constraints. In addition, participants are introduced to the fundamentals of life-cycle cost analysis as well as risk management and other program issues.

LEARNING METHODS

The learning methods include lectures, discussions, group exercises, and other activities, including actual system engineering problems of all types, with an emphasis on NASA missions and systems.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Explain the rationale for and the value of systems engineering concepts and principles
- Define various systems engineering-related terms and explain the systems engineering process
- Describe the system life cycle and various systems engineering life-cycle models, phase gates, reviews, and standards
- Apply the systems engineering process and principles from the identification of a customer or other stakeholder need through a System Requirements Review (SRR)

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Mission needs statement; stakeholder management; system architecture; technical requirements definition

NOTES

Please note that this course is based on the Stevens Institute of Technology's "Fundamentals of Systems Engineering course (SYS 625)."

The American Council on Education (ACE) has recommended that 2 transferable graduate level credits be awarded for the successful completion of this course.

This course is registered by the Project Management Institute (PMI) for 36 Professional Development Units (PDUs). PMI Course ID: CESA30

DECISION ANALYSIS (APPEL-DA)

AUDIENCE

This course is designed for NASA's technical workforce, including systems engineers and project personnel involved in project teams or small projects.

GOAL

This two-day course is designed to provide the tools necessary to improve the quality of a factually based decision-making process for resolving technical issues at NASA.

LEARNING METHODS

Case studies, small group applications, and informed discussions with knowledgeable resources will serve as the basis for course activities.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Identify Decision Analysis relationship to NPR 7123.1A, NASA Systems Engineering Processes and Requirements, including role of Systems Engineering Management Plan (SEMP)
- Recognize factors contributing to successful and unsuccessful decision-making
- Apply a standard process for decision-making
- Identify which technical issues are subject to formal evaluation, and discern the differences between a well-framed problem and a poorly framed one

- Define the criteria used for evaluation, and identify alternative solutions to address decision issues
- Select evaluation methods and tools, and assess alternative solutions with respect to evaluation criteria
- Make a decision, document, and evaluate decision impact

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Technical decision analysis; systems engineering; communication and decision making

NOTES

The American Council on Education (ACE) has recommended that 1 transferable graduate level credit be awarded for the successful completion of this course.

DEVELOPING AND IMPLEMENTING A SYSTEMS ENGINEERING MANAGEMENT PLAN (APPEL-SEMP)

AUDIENCE

This course is designed for NASA's technical workforce, including systems engineers and project personnel developing the competencies required to succeed as a leader of a project team, functional team, or small project.

GOAL

This three-day course introduces participants to the processes that support planning, development and execution of a Systems Engineering Management Plan (SEMP). Participants learn how to create a SEMP in compliance with NASA standards. In addition, they learn how technical planning complements the project planning to create the next-level guidance for a technical team. They learn how to schedule technical reviews, systems engineering activities, technology insertion, and detailed technical activities. They learn the importance of technical management in the execution of any project, and how to use technical leadership to keep a project on track.

LEARNING METHODS

Learning is accomplished through lectures, discussions, group exercises, and other activities, including case studies involving the planning, development, monitoring and assessment of systems engineering activities using a SEMP. Cases emphasize NASA missions and systems.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Describe the importance of technical planning and technical management
- Describe how the technical plan coordinates with a project plan
- Document a technical plan in a NASA-compliant Systems Engineering Management Plan (SEMP)
- Explain the NASA procedural requirements (NPR 7123.1A for systems engineering and 7120.5D* for project management) to create a technical plan
- Define the technical work necessary and sufficient to complete a project
- Describe the characteristics and elements of a good technical plan
- Describe the flow of systems engineering activities that guide a project
- Select appropriate technical reviews, metrics and measurements to assess project progress
- Explain how to use the SEMP to control scope during project execution

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Project planning; systems engineering management

NOTES

This course is registered by the Project Management Institute (PMI) for 23 Professional Development Units (PDUs). PMI Course ID: SEMP11

EXPLORATION SYSTEMS AND SPACE OPERATIONS (APPEL-EXPO)

AUDIENCE

This course is designed for NASA's technical workforce, including engineers, systems engineers and project personnel involved in creating overall mission architectures, detailed design and the operation of systems.

GOAL

This three-day workshop focuses on creating a phased, conceptual design for complete Earth-orbiting, lunar, and Mars manned missions. It provides an overview of human space exploration including the vision for the future, objectives and strategies, as well as a view of upcoming technologies and missions.

LEARNING METHODS

An integrated example of a Lunar Base Mission is used throughout the course to illustrate each of the design areas covered. This example enables hands-on, practical experience in applying the information and tools provided. The course involves real-world design exercises aimed at helping participants apply the techniques and guidelines presented once they return to work. All participants receive a complete set of course notes and the authoritative text *Human Spaceflight* by Giffen and Pranke.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Interpret and convert space mission objectives, requirements, and constraints into visible and cost-effective operations concepts
- Develop and apply hazards and mitigation techniques
- Explain the physiology of space flight, human factors, and psychological aspects
- Describe a process-oriented approach for creating cost-effective space missions
- Describe the key functions that must be performed for mission operations
- Apply effective methodology for translating space mission objectives, requirements, and designs into viable and cost-effective operations concepts
- Explain the interrelationships and trade-offs between system design and mission operation

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Agency structure and goals; system architecture; mission design; operations

FUNDAMENTALS OF SYSTEMS ENGINEERING (APPEL-FSE)

AUDIENCE

This course is designed for junior to mid-career NASA systems engineers, functional engineers, project managers, integrated product team members, and business managers.

GOAL

This course introduces the methods and techniques for a structured systems development process that proceeds from requirements to concept to production to operation and is based upon NASA policy guidelines, specifically NASA Procedural Requirements (NPR) 7123.1A and 7120.5D.* The NASA practice of systems engineering is the glue across all engineering and project management disciplines that ties customer needs to the right solution. Systems engineering focuses on the interfaces between the people, processes, and products that are often outside the responsibility of any one function or discipline. This course equips your teams with the knowledge necessary to realize successful solutions.

LEARNING METHODS

Learning will be accomplished through lecture and class discussion. Attendees will practice the 'how-to' of the principles through case studies and illustrative examples. Practical exercises provide experience in the techniques and decisions required in a real world environment.

If the hands-on life cycle activity option is selected, the participants will develop and present appropriate artifacts and content based upon a real NASA case study. This activity will be conducted post-course with guidance from the instructor.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Explain the purpose of systems engineering
- Describe the systems engineering process incorporating NASA

policy guidelines (NPRs 7123.1A and 7120.5D)
- Explain the process for system requirements development and management
- Describe the system definition process (concepts and architecting)
- Defend project decisions and trade-off analyses
- Analyze product and project risk and mitigation based upon NASA policies and practices
- Examine reliability, availability, and supportability factors during the design process
- Explain performance measurement needs
- Describe the system implementation process
- Explain verification and validation activities

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Purpose of systems engineering; systems engineering processes incorporating NASA Procedural Requirements (NPRs) 7123.1A and 7120.5D; system definition process (concepts and architecting); incorporating reliability, availability and supportability considerations into the design process; system implementation process

NOTES

The American Council on Education (ACE) has recommended that 2 transferable graduate level credits be awarded for the successful completion of this course.

This course is registered by the Project Management Institute (PMI) for 40 Professional Development Units (PDUs). PMI Course ID: FSE031

LIFE CYCLE, PROCESSES, AND SYSTEMS ENGINEERING (APPEL-LPSE)

AUDIENCE

This course is designed for NASA's technical workforce, including systems engineers and project personnel who seek to develop the competencies required to succeed as a leader of a project team, functional team, or small project.

GOAL

This three-day course introduces systems engineering processes, NASA life-cycle phases, key technical reviews, and systems engineering management techniques. The course helps you realize the value of well-established systems engineering processes and deliverables.

LEARNING METHODS

Lectures, discussions, exercises, and other activities including structured systems engineering processes and management undertakings enhance the learning experience.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Define and demonstrate engineering of systems processes as illustrated in the NASA Procedural Requirements (NPR) for systems engineering (NPR 7123.1A) and project management (NPR 7120.5D*)
- Explain operations concepts, their development and their impact on the system of interest
- Define system architecture functions and analyze their functional performance

Real-world **TECHNIQUES** were helpful, **ESPECIALLY** talks on conducting **TRADE STUDIES** and the Monte Carlo **APPROACH.**

- Define system technical solution options and describe how trade studies are performed
- Map architecture functions to subsystems and define the relationships among the subsystems
- Describe internal and external interface definitions, designs, and changes for products and product components
- Explain the importance of establishing a technical planning process for a given system of interest
- Identify tools used for systems engineering activities

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Project planning; NASA project management and systems engineering procedures and guidelines; systems engineering

NOTES

The American Council on Education (ACE) has recommended that 1 transferable graduate level credit be awarded for the successful completion of this course.

MARS MISSION AND SYSTEMS DESIGN LAB (APPEL-MMSD)

AUDIENCE

This course is designed for NASA's technical workforce, including engineers, systems engineers and project personnel involved in creating overall mission architectures, detailed design, and the operation of systems.

GOAL

This four-day lab is designed to provide real-life experience conceptualizing and designing space missions to Mars or the moon. This lab provides an integrated view of space mission design and operations, from conceptual design and requirements definition through spacecraft design, development, test, and launch to development of mission operations concepts and ground infrastructure capabilities.

LEARNING METHODS

A variety of learning methods are used, including lecture, group discussion, exercises and videos. Participants will be introduced to various demonstrations using a CD for Satellite Tool Kit with a temporary full-use license. Hands-on exercises introduce the Space Mission Analysis and Design Software Tool, specifically tailored to Mars or the moon.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Demonstrate space systems engineering processes

- Formulate development strategies for systems engineering management, technical integrity, and technical leadership.
- Assemble all the elements of a mission successfully through a process of integration
- Set up a process to refine requirements and define parameters to meet mission objectives at acceptable costs and risk
- Apply processes in a non-threatening environment
- Apply systems-level thinking to projects

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Systems engineering; system architecture; mission design; operations

REQUIREMENTS DEVELOPMENT AND MANAGEMENT (APPEL-REQ)

AUDIENCE

This course is designed for NASA's technical workforce, including systems engineers and project personnel who seek to develop the competencies required to succeed as a leader of a project team, functional team, or small project.

GOAL

This three-day course provides a firm foundation for the development and management of a project's product requirements. This course presents the participant with best practices that, when incorporated into the requirement development and management process, will help a project team develop a winning

product—one that delivers what is needed, when it is needed, within the projected costs and with the expected quality.

LEARNING METHODS

Lectures, discussion, and individual and small-group learning exercises help participants learn how to develop and manage product scope and requirements. Writing exercises and peer reviews reinforce and expand learning.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Identify the benefits of defining scope at the beginning of your product development process
- Identify and describe the importance of drivers and constraints
- Develop and describe the importance of operational concepts
- Explain product scope, product validation and baselining
- Identify the characteristics of good and well-written requirements
- Explain the levels of requirements, how requirements are linked, and the iterative nature of requirement decomposition
- Explain the importance of allocation and how to allocate requirements
- Identify types of requirements that must be defined and write good requirements
- Describe the processes, activities, and tools that are used to manage requirements throughout the product life cycle
- Describe management's role in requirements management activities
- Explain how and why a requirements development and management process needs to be defined and followed

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Requirements development; logical decomposition; requirements management

NOTES

This course is registered by the Project Management Institute (PMI) for 21 Professional Development Units (PDUs). PMI Course ID: S30012

REQUIREMENTS DEVELOPMENT AND MANAGEMENT - TEAM (APPEL-REQ-T)

AUDIENCE

This course is designed to meet the needs of intact project teams, including project managers, systems engineers, users, customers, developers, testers and other relevant stakeholders. Anyone involved in the development, review or management of project scope and system or product requirements for a project will benefit from this training. The seminar is applicable to projects large and small as well as hardware and software projects of all sizes.

GOAL

This three-day course provides a project team with just-in-time-training for the development and management of the project's product scope and requirements. During this course, the project's existing scope and requirements documentation are reviewed and used to allow participants to determine which areas need improvement and further work. The resulting effort is improved project scope, requirements, action items and better communication between team members. This course will help the project team apply requirement engineering best practices necessary to develop a winning product—one that delivers what is needed, when it is needed, within the projected costs and with the expected quality.

LEARNING METHODS

Lectures, discussion, and individual and small-group learning exercises will help the project team learn how to develop and manage the project's product scope and requirements. Exercises are included based on the project's existing requirements allowing participants to improve their project's requirements as part of the seminar.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Define a project's product need, goals, and objectives
- Identify drivers and constraints
- Develop and document operational concepts
- Identify and define a product's external interfaces
- Explain product scope, product validation and baselining
- Identify the characteristics of good and well-written requirements
- Write requirements at the correct level and to link requirements
- Correctly allocate requirements
- Identify types of requirements that must be defined
- Apply continuous and discrete requirement validation activities to remove requirement defects

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Requirements development; requirements management

SCIENCE MISSION SYSTEMS DESIGN AND OPERATIONS (APPEL-SMSDO)

AUDIENCE

This course is designed for NASA's technical workforce, including engineers, systems engineers and project personnel involved in creating overall mission architectures, detailed designs and the operation of systems.

GOAL

This three-day course provides an integrated view of space science mission design and operations from conceptual design and requirements definition, through spacecraft design, development, and test, to development of mission operations concepts and ground infrastructure capabilities.

LEARNING METHODS

Learning will be enhanced through lectures, group discussions, videos, demonstrations and multiple team activities applying materials from previous NASA missions.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Define the components and systems of a robotic space mission
- Describe an integrated view of space science mission design and operations
- Describe the interrelationships between systems design and mission operations
- Describe a process-oriented approach for creating cost-effective space missions
- Apply effective methodologies for translating space mission objectives, requirements, and designs into viable and economical operations concepts
- Demonstrate practical, detailed ideas and tools to analyze and design space segment support for unmanned missions, including architecture and configuration, payloads, and vehicle subsystems

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Unmanned space missions; agency structure and goals; system architecture; mission design; operations

SCIENCE MISSION SYSTEMS DESIGN AND OPERATIONS - LAB (APPEL-SMSDO LAB)

AUDIENCE

This course is designed for NASA's technical workforce, including engineers, systems engineers and project personnel involved in creating overall mission architectures, detailed designs, and the operation of systems.

GOAL

This four-day lab is designed to provide real-life experience for conceptualizing and designing space missions. The lab provides an integrated view of space mission design and operations, from conceptual design and requirements definition through spacecraft design, development, test and launch, to mission operations concepts and ground infrastructure design.

LEARNING METHODS

Participants will be given a bona fide, real-life mission objective and divided into competing groups or teams to conceptually design a mission to meet the objectives at an acceptable life-cycle cost. Other learning methods include lectures, group discussions, demonstrations, and videos. All participants receive a complete set of course notes, the authoritative text *Space Mission Analysis and Design* by Larson and Wertz, and an integrated software tool for performing detailed space mission design.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Describe and apply an integrated approach to space mission design and operations
- Develop mission concepts and supporting architectures to meet specific mission objectives
- Develop effective techniques for providing customers and stakeholders with space mission concepts and architecture in the most cost-effective manner possible
- Apply an effective methodology for translating space mission objectives, requirements, and designs into viable and cost-effective operations concepts

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Systems engineering; system architecture; mission design; operations

SPACE LAUNCH AND TRANSPORTATION SYSTEMS (APPEL-SLTS)

AUDIENCE

This course is designed for NASA's technical workforce, including engineers, systems engineers and project personnel involved in creating overall mission architectures, detailed designs and the operation of systems.

GOAL

This three-day course is intended to provide practical, detailed approaches and tools to analyze and design manned and unmanned and reusable and expendable launch vehicles for Earth and other planets. This includes architecture and configuration, payloads and vehicle subsystems.

LEARNING METHODS

Lectures, discussions, group exercises, videos, and physical examples will increase participants' understanding of space launch and transportation systems.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Identify practical tools and processes for the analysis and design of manned and unmanned, reusable and expendable vehicles for Earth and other planets
- Describe a process-oriented approach for creating cost-effective space launch and transportation systems to meet broad, often poorly defined requirements
- Apply effective methodologies for translating space launch and transportation system (SLTS) objectives, requirements, and designs into viable and economical operations concepts
- Explain the components of space launch and transportation systems design and operations
- Define the parameters for evaluating the life-cycle cost of space launch and transportation systems
- Identify technical risks and mitigate them in the most cost-effective manner while maintaining the technical integrity of the vehicle(s) and infrastructure
- Describe launch operations functions that must be performed
- Describe the interrelationships and trade-offs between system design and mission operations

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Launch vehicles; system architecture; mission design; operations

SPACE SYSTEM VERIFICATION AND VALIDATION (APPEL-SSVV)

AUDIENCE

This course is designed for NASA's technical workforce, including engineers, systems engineers and project personnel involved in creating overall mission architectures, detailed designs, and the operation of systems.

GOAL

This three-day course demonstrates the processes, information, and tools necessary to implement a credible verification, integration and test program. It provides exposure to NASA and Department of Defense (DoD) standards, lessons learned, tools, and experiences in validation and verification.

LEARNING METHODS

This course provides a hands-on system validation and verification learning laboratory. Lectures, small group exercises, and videos will also enhance the learning experience. Participants plan test campaigns, execute tests, integrate subsystems, and conduct test reviews using a unique desktop satellite called Eyasat.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Explain the end-to-end systems engineering process and its application to system (and lower level) requirements definition, allocation, validation, and verification
- Describe the purpose and scope of key documents required in the validation and verification processes, and describe typical errors committed
- Describe various methods of verification, and determine when they are appropriate and how they are used as part of a verification plan
- Assess applicability of verification methods to prototype and protoflight systems
- Describe capabilities of various automated requirements tracking tools (e.g., CORE and DOORS) and their applicability to the validation and verification process
- Develop, evaluate, and implement a master verification plan for a space system, including hardware, software and associated ground support equipment (GSE)
- Apply processes and techniques in a hands-on workshop associated with a system of interest
- Identify applicable NASA, ECCS, DoD, and Industry standards and lessons learned to support system verification decisions and activities

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Product verification; product validation

TRANSITION, PRODUCT DELIVERY, AND MISSION OPERATIONS (APPEL-TPDMO)

AUDIENCE

This course is designed for NASA's technical workforce, including systems engineers and project personnel who seek to develop the competencies required to succeed as a leader of a project team, functional team, or small project.

GOAL

This four-day course is intended to demonstrate the processes, procedures, and strategies necessary to implement effective product development, transition, delivery, and operations.

LEARNING METHODS

Learning will be through lectures, discussions, group exercises and activities such as actual product development, transition, and discussion of operations problems of all types (with an emphasis on NASA missions and systems).

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Describe the enabling processes for product development or acquisition
- Describe the various activities/ strategies that support effective product implementation
- Describe the evaluation process of enabling product readiness
- Evaluate validation of lower level procured products and preparation of the environment for integration
- Develop a plan for

product integration
- Identify the "active ingredients" of product integration documentation
- Describe product verification and validation processes and how the outcomes are analyzed and reported, including all the support documentation
- Identify the various documentations that support product transition
- Identify product transition processes, procedures, and enabling product needs
- Assess the value of operations planning and execution
- Identify the processes for product operations

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Product implementation; product integration; product verification; product validation; product transition; product operations

UNDERSTANDING NPR 7123.1 SYSTEMS ENGINEERING PROCESSES AND REQUIREMENTS (APPEL-USEPR)

AUDIENCE

The intended audience for this course is NASA personnel working on a technical team that engineers systems or parts thereof, or oversees the engineering of a system by contractors. This may include systems engineers, system engineering managers, project managers, program executives, members of the technical community, and other mission support personnel, such as contracting officers and acquisition personnel.

GOAL

This two-day course is designed to help participants understand the purpose and use of the NPR 7123.1 requirements and related processes, activities, tasks, and best practices. This course helps participants gain an appreciation for the lessons of the past, as well as knowledge to effectively lead or participate as a technical team member in the engineering of NASA systems.

LEARNING METHODS

This enhanced learning experience includes lectures, discussions, exercises, and other activities led by some of NASA's leaders in systems engineering.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Describe the NASA systems engineering requirements and practices, per NPR7123.1, NASA Systems Engineering Processes and Requirements and NASA/SP-2007-6105, NASA Systems Engineering Handbook
- Explain the context of systems engineering within the project life cycle
- Demonstrate an understanding of the relationship of systems engineering with project management
- Explain the use of the NASA systems engineering engine, and describe the academic and practical sides of systems engineering
- Describe and demonstrate an appreciation for the "art" of systems engineering
- Describe the purpose, inputs and outputs, and activities associated with the 17 processes of the NASA systems engineering engine

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Stakeholder expectations definition; technical requirements definition; logical decomposition; design solution definition; product implementation; product integration; product verification; product validation; product transition; technical planning; requirements management; interface management; technical risk management; configuration management; technical data management; technical assessment and decision analysis

Engineering Courses

The Academy's engineering courses focus on engineering essentials, critical thinking, lessons learned, and space systems to strengthen NASA-specific engineering expertise and capabilities.

ESSENTIALS OF ASTRONOMY FOR NASA ENGINEERS (APPEL-ASTRO)

AUDIENCE

This course is for NASA engineers and technicians who have minimal astronomy training and would like to gain a foundational understanding of the philosophical underpinnings and the "big picture" of astronomy.

GOAL

Most engineers earn undergraduate degrees without a foundational background in astronomy, yet their daily work at NASA is ultimately connected to cutting-edge exploration programs. This course offers participants a physical and philosophical understanding of our universe, allows them to more fully appreciate the scope of and rationale behind the work they are involved in, and inspires a continued interest in astronomy.

LEARNING METHODS

Fundamental knowledge of the universe and observational astronomy is achieved through lectures that include a wide variety of multi-media resources, together with thought-provoking interactive discussions. Key NASA programs that have proved invaluable to the astronomy community are also highlighted. An optional observation night is also offered in conjunction with this course, when possible, to tour the night sky.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Recall the high-level essentials of the history and science of astronomy, including findings by ancient philosophers, Newton, and Einstein;
- Explain the basics of observational astronomy, including the calendar, seasons, and eclipses;
- Describe the physical creation, elements, timeline, scale, and physical evolution of the universe, solar system, stars, galaxies, and other astronomical bodies, as well as explain its current state and ultimate demise;
- Discuss various resources leveraged for space studies (telescopes, spacecraft, remote sensing instruments, etc.) and differentiate their intended uses;
- Develop a deeper appreciation for the majesty of the worlds explored through engineering abilities, and defend the importance of NASA exploring the universe; and;
- Use, as an engaged hobbyist, recommended astronomy hardware, software, and educational tools and resources to continue learning about the universe.

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

High-level history and science of astronomy; basics of observational astronomy; creation of the universe, its current state, and ultimate demise; different uses of various space studies scientific instruments and spacecraft

DESIGN FOR MANUFACTURABILITY AND ASSEMBLY (APPEL-DMA)

AUDIENCE

This course is for the NASA technical workforce and program managers involved in the design, manufacture, and assembly of space program hardware who wish to become familiar with key technological information on manufacturing processes of strategic interest to NASA.

GOAL

This course was developed with the input of engineers and craftsmen throughout the agency to introduce participants to the skills and insight necessary to design mechanisms, devices, and structural components and produce them quickly, cost effectively, and of high quality. Participants will learn how to create products that function correctly and robustly, and about the importance of early involvement of key stakeholders.

LEARNING METHODS

This three-day introductory course is presented in a Design For X (DFX) format, where X can be manufacturability, assembly, serviceability, or other technological needs. The course includes a modular, expert-led lecture with visuals, videos of key manufacturing processes, in-class demonstrations, case studies, and group exercises. A NASA machine shop tour and/or machinist / designer panel discussions are also

offered in conjunction with this course when possible.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Describe how the integrated design, manufacturing, and assembly process works
- Explain the standard set of design rules and guidelines associated with the processes being considered
- Apply a concurrent engineering design process that includes Design for Manufacture early in the product realization process, and team collaboration throughout
- Recall knowledge sources for the design for manufacture processes, then use them to best select between several competing processes
- Discuss the science and physics of machining, and general manufacturability guidelines for different machining operations
- Calculate a product's major cost, schedule, and quality drivers
- Employ Geometric Dimensioning and Tolerancing (GDT) concepts and practices
- Propose typical tolerances, surface finishes, and process times that are easily achievable, and those that are achievable only with significantly extra time, cost, and/or effort

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Integrated design, manufacturing, and assembly process; typical machining operations, tolerances, surface finishes, and process times; standard design rules and guidelines; cost, schedule, and quality drivers

NOTES

The American Council on Education (ACE) has recommended that 1 transferable graduate level credit be awarded for the successful completion of this course.

EARTH, MOON, AND MARS (APPEL-EMM)

AUDIENCE

This course is for NASA engineers and scientists who are interested in understanding the geological systems and events that shape Earth, and then relating that knowledge to the moon, Mars, and other planetary bodies.

GOAL

Most engineering majors in academia are not required to take a course in geology. At NASA, engineers are tasked with exploring our own planet, the moon, and Earth's closest neighbor Mars. Participants will learn how planetary bodies are formed, the kinds of dynamic geologic processes that continue to operate on them today, and theories about their futures. Participants also discover unique geologic properties of the moon and Mars, and the challenges of exploring them with robots and humans.

LEARNING METHODS

This three-day survey course features lectures and interactive classroom discussions. Participants examine the current ideas about the structure, dynamics, and composition of the moon and Mars, using evidence from meteorites, satellite remote sensing, and previous NASA missions (manned and unmanned) to their surfaces. Real rock, mineral, and fossil samples are also used in the classroom to further explain the Earth's geological processes.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Debate hypotheses about the formation and history of Earth, the moon, Mars, and other planetary bodies
- Describe the dynamic systems that continue to shape our planet and how they impact life on Earth, such as energy sources, water availability, climate change, and natural hazards
- Recognize the forces and influences (such as life) that continue to change Earth, the moon, and Mars
- Examine geological conditions that humans could face as they continue to explore the moon, Mars, and other planetary bodies
- Describe how different planetary compositions may affect lunar and Martian vehicles and landing gears
- Identify potential signatures of ancient life that might still remain on Mars

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Formation, history, and composition of Earth, the moon, Mars, and other planetary bodies; Earth's dynamic geological systems; forces and influences that continue to change Earth, the moon, and Mars; lunar and Martian geology and their impact on design of exploration vehicles and landing gears; science of the solar system; searching for life

INTRODUCTION TO AERONAUTICS (APPEL-I-AERO)

AUDIENCE

This course is designed for anyone interested in a big-picture overview of aeronautics. No technical background is necessary.

GOAL

This four-day course is all about aircraft – how they fly, and why they look the way they do. Using design as a common thread, this course provides a solid understanding of the basics of aeronautical engineering, including low- and high-speed aerodynamics, stability and control, structures and materials, propulsion systems, and aircraft performance. Although the focus is clearly on conventional aircraft, discussion will include other air vehicles including airships, helicopters, stealth, hypersonic, unmanned, short takeoff and landing (STOL) vehicles, and micro-air vehicles. At the end of this course, participants will be able to identify and understand the design features of an aircraft and have an appreciation for the impact of modifying its design (for example, adding tip tanks).

LEARNING METHODS

Lectures, hands-on exercises, practical examples, and discussions are employed to support the lesson objectives. In addition, an off-site visit to a local aircraft museum, airport, or aero club reinforces the classroom discussions.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Explain why standard atmosphere is important in the field of aeronautics
- Define lift and drag, explain how lift is generated, and identify the various components of drag
- Explain why an aircraft "stalls" at a high angle of attack

EVERYTHING in this course **WAS VALUABLE.** I have a better **UNDERSTANDING** of lift, drag, and thrust, and I have **BETTER INSIGHT** to **PROPULSION.**

- Describe how flow properties change across a shock wave and an expansion wave
- Describe design techniques used to minimize drag due to lift and wave drag
- Explain the significance of (L/D) max and locate (L/D) max on a drag-versus-velocity graph
- Identify high-lift devices and state their purpose
- Name the aircraft axes, the motion of each, and the conventional control surface(s) that produce each motion as well as describe the pilot's input
- Identify design and operational factors that contribute to achieving pitch stability
- Describe the structural considerations and elements of a given aircraft
- Explain how thrust is generated and demonstrate an understanding of the trade-offs associated with aircraft/engine integration
- Identify and explain the impact of six factors (e.g., density altitude) on takeoff and landing performance.

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Aeronautics; aircraft design fundamentals; stability and control; aircraft aerodynamics; aircraft performance; propulsion systems

INTRODUCTION TO GREEN ENGINEERING (APPEL-GREEN)

AUDIENCE

This course is for NASA engineers, scientists, managers, technicians, and environmental professionals to gain basic knowledge of green engineering and sustainability, and their applications within NASA projects and missions.

GOAL

This course offers a fundamental understanding of green engineering, green technology, life cycle assessment, sustainability, and environmental regulations. Participants will gain an understanding of how to integrate

various green concepts, materials, disciplines, and tools. It will also enable participants to acquire and develop expertise that promotes sound and sustainable practices within the development of systems, processes, and hardware.

LEARNING METHODS

This survey course features lectures supplemented with multimedia resources and informative panel discussions. The course will also include relevant NASA-specific content. Additionally, this course will feature discussions with NASA's Senior Sustainability Officer and centers' local sustainability representatives to become more familiar with NASA's sustainability policy, goals, and activities. Participants will also learn about existing green engineering and sustainability NASA expertise and available resources (agency-wide and at individual centers) that can be leveraged in future projects.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be better prepared to:

- Employ environmentally conscious designs, materials selection, and manufacturing techniques—enhanced through interdisciplinary teamwork
- Identify life cycle requirements, costs, environmental considerations, and risks, and learn engineering life cycle assessment (LCA) techniques
- Design and develop materials, products, processes, hardware, and systems that are inherently safer, generate less waste, and use energy efficiently and effectively
- Communicate key engineering challenges, their environmentally-driven causes and impacts, potential solutions, and future requirements
- Practice minimizing impacts associated with environmentally-driven risks, especially through an understanding of policies, regulations, and other external requirements (U.S. and international)
- Use available green engineering, green project management, and sustainability tools and resources, along with NASA expertise, within system design and development efforts
- Recognize their personal roles in fostering a sustainability culture within NASA, and support their center in achieving sustainability targets and goals

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Environmentally conscious designs, materials selection, and manufacturing techniques; life cycle assessment requirements, considerations, and techniques; safety, waste, and energy considerations; internal and external policies, regulations, and requirements for green engineering and sustainability; green engineering, green project management, and sustainability tools, resources, and expertise

INNOVATIVE DESIGN FOR ENGINEERING APPLICATIONS (APPEL-IDEA)

AUDIENCE

This course is for NASA's technical workforce, including systems engineers and program personnel, who are seeking proven ways within their project teams to be creative and innovative that do not increase risk and cost.

GOAL

By nature, engineers tend to be conservative. This is a necessary trait, especially in the NASA community, where engineers must develop complex hardware that withstands the harshest of environments while generating critical data and executing successful missions. This course stimulates and motivates analytically minded engineers to think more creatively and consider new ways to innovate and communicate their engineering designs by familiarizing participants with the framework of innovation and the various design aspects of creative solutions.

LEARNING METHODS

This highly interactive, three-day course familiarizes learners with the framework of innovation and the various design aspects of creative solutions. This is accomplished through the introduction of several established problem-solving techniques used in other industries such as the Pugh and TRIZ methods. Participants also undertake integrated projects in class that focus on hardware design, system performance, and strategies for lateral ways of approaching technical challenges and solutions. The expert-led lectures, hands-on class exercises, case study videos, open discussions, brainstorming, and group exercises allow participants to apply newly learned techniques to specific design problems and begin to "train their brains" to problem-solve in a more innovative manner. Most classroom exercises and embedded activities are driven by actual NASA case studies.

Essential Class Tour

To highlight innovative and creative solutions that answer real-world technical problems, hardware and mechanical systems tours have been built into this course. These on-site "innovation tours" afford participants opportunities to learn about real projects or facilities firsthand from those personally involved.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Demonstrate different modes of creative thinking (e.g., physical vs. visual problem solving) and effective methods for positively communicating new ideas
- Identify sources for creativity themes, such as referential, internal, and customers
- Explain the hard and soft sides of innovation and how to create the best environment and atmosphere for creativity
- Evaluate proven tools for innovation, such as the Pugh or TRIZ methods, and apply them to existing NASA project challenges
- Describe common innovation best practices used in industry and relate them to real NASA program scenarios
- Review design models, design environments, and design constraints, then demonstrate methods of designing for the user, including human/bio design, ethnography, and issue identifications
- Explain effective prototyping techniques used inside and outside of NASA
- Recall tools that help improve reliability, reduce errors and costs, and speed up manufacturability and assembly
- Describe open innovation and open networks, and explain how they, and which ones, are used at NASA

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Product design models, processes, environments, and constraints; effective brainstorming and communication methods; modes of creative thinking and sources of creativity; user-centered design and prototyping; tools for improving reliability, reducing errors and costs, speeding up manufacturing and assembly; innovation tools, best practices, environments, and networks

NOTES

The American Council on Education (ACE) has recommended that 1 transferable graduate level credit be awarded for the successful completion of this course.

This course is registered by the Project Management Institute (PMI) for 24 Professional Development Units (PDUs). PMI Course ID: IDEA32

NASA MISSIONS: ENGINEERING EXPLORATION (APPEL-MSN)

AUDIENCE

This course is for NASA engineers and technicians who perform "engineering in the service of exploration" and want to gain a better understanding of human spaceflight and robotic missions—past, present, and future—that resulted, or will result, from technological pushes, geopolitical factors, and personal passion.

GOAL

This course enables participants to recognize how the driving forces behind agency-wide successes are more than science and analytics, and how innovation, teamwork, persistence, and passion are key components of an engineer's daily work. Through discussions of NASA's past accomplishments, current undertakings, and potential future endeavors—as seen from engineering, scientific, historical, and human perspectives—participants learn to apply these insights in their own daily thinking. They will also comprehend the rationale for and importance of the endeavors that support the agency's current vision, and be able to personally craft and publicly convey the purpose and significance of the nation's space program in their own words.

LEARNING METHODS

This three-day course offers an expert-led, multi-media rich presentation detailing 50+ years of NASA's key historical, current, and future programs. It is augmented by highly interactive discussions, along with behind-the-scenes personal stories and thoughts from the instructor and participants themselves.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Discuss the history, engineering successes, and biographical anecdotes of major NASA human spaceflight missions (including Mercury, Gemini, Apollo, Skylab, Apollo-Soyuz, Space Shuttle, Shuttle-Mir, and International Space Station);
- Explain the purpose and accomplishments of major NASA robotic missions, (including early near-Earth, Earth-observation, lunar, inner and outer solar system, and space-based astronomy missions);
- Examine future NASA missions, technical challenges, and associated timelines for human spaceflight programs (ISS, Constellation, commercial partnerships); robotic missions (James Webb Telescope, Terrestrial Planet Finder, Mars Science Laboratory, Mars Sample Return, Europa ocean exploration); and the challenges involved with sending humans to the moon, Mars, asteroids;
- Defend—internally and in public forums—the rationale and importance of the NASA space program, including its significant role in technology research and development, education, exploration, national security, the US economy, and humankind's long-term survivability;
- Formulate the "annual cost of NASA" in terms that the public can relate to, and then communicate the message
- Employ myriad recommended resources for learning and communicating more about NASA's history, present missions, and future endeavors

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

History, engineering successes, and personal points-of-view of major NASA human spaceflight missions; purpose and accomplishments of major NASA robotic missions; technical challenges and proposed timelines of future NASA programs and missions; internal and public communications of the importance of NASA, its national and global roles, and its cost

SEVEN AXIOMS OF GOOD ENGINEERING (APPEL-SAGE)

AUDIENCE

This course is for NASA engineers and project managers who are interested in understanding the role of historical case studies and engineering failures in critical thinking and good engineering design processes, and learning how to avoid classic design errors.

GOAL

This course takes a reflective look at numerous case studies, both from within NASA and the outside world, to discover where the root causes of most failures reside. After a brief introduction to design, participants investigate various failure examples, then lead themselves to the discovery and on-the-job application of axioms that bring a non-technical, yet crucial, sense of wisdom to the engineering design and project management decision-making processes.

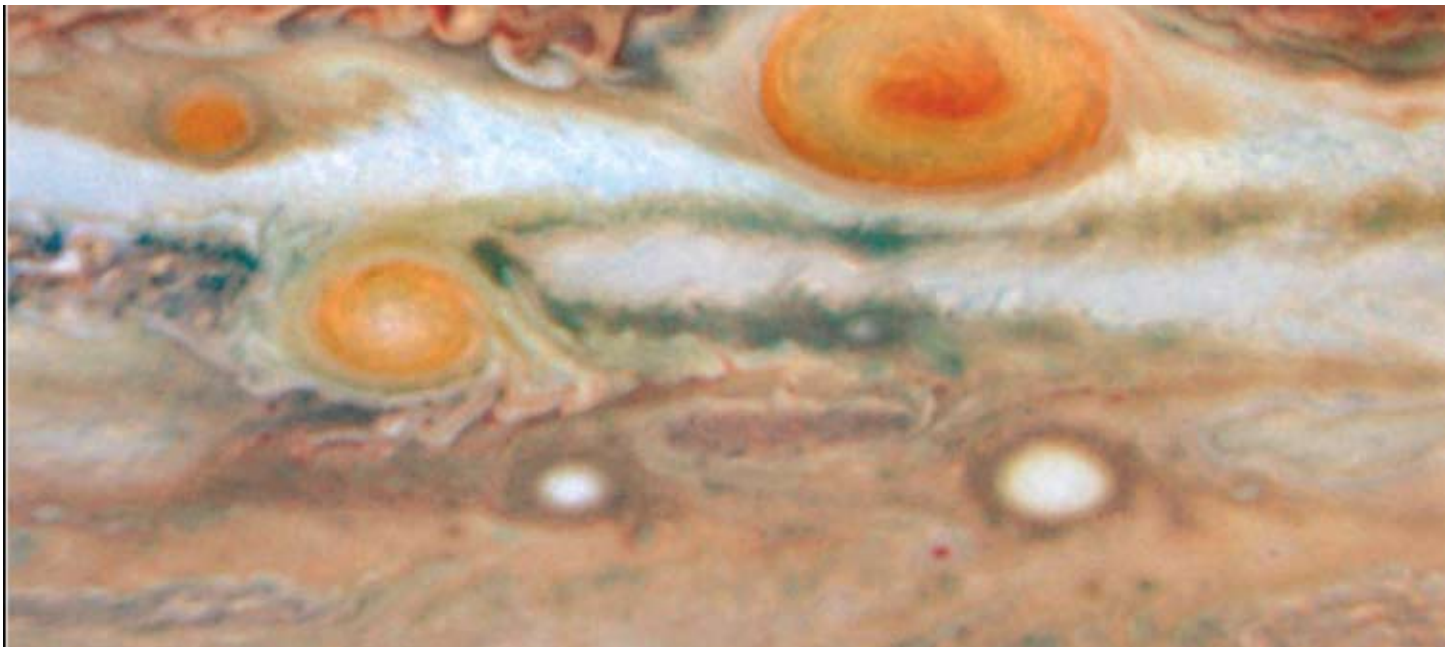
LEARNING METHODS

This three-day course presents seven key concepts for axiomatic design, including: 1) avoiding a selective use of historical design data; 2) extrapolating existing data into unknown regions of the design space only with extreme caution; 3) understanding the design's sensitivity and robustness; 4) always testing against physicality; 5) guarding against unanticipated loads and/or failure modes; 6) avoiding highly coupled system unless a strong benefit is shown; and 7) ensuring human understanding of how the system works. Participants discuss historical case studies on failure, including: GE refrigerator rotary compressor failure; space shuttle Columbia accident; Apollo liquid oxygen (LOx) tank; Pioneer 10 spacecraft; recurring mistakes in suspension bridge design; Hubble Space Telescope primary mirror; U.S. Navy's Mark 14 magnetic exploder malfunction; Kansas City Hyatt Regency walkway collapse; Ocean Ranger sinking; and the Three-Mile Island partial meltdown. Participants also are expected to create design corollaries and a case study based on their own personal experiences, and then present their engineering design cases to the class, highlighting pertinent engineering axioms.

SPECIFIC OBJECTIVES

Upon completion of this course, participants will be able to:

- Recognize the value of case studies in critical thinking through the extraction of key decision-making aspects associated with engineering processes
- Define and explain the seven design engineering axioms, and recognize ways that classic errors occur and ways to avoid them
- Employ non-analytical insight



as part of the design process
- Transform design data into design knowledge
- Practice researching and incorporating lessons learned into everyday design processes
- Evaluate one's own successful and failed design projects to create case studies that highlight and share good and bad engineering practices.

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Seven key engineering design principles and classic design errors; critical thinking, technical decision-making, and engineering best practices; non-analytical aspects of design; practice of researching case studies and lessons learned in everyday design processes

NOTES

The American Council on Education (ACE) has recommended that 1 transferable graduate level credit be awarded for the successful completion of this course.

This course is registered by the Project Management Institute (PMI) for 24 Professional Development Units (PDUs). PMI Course ID: SAGE33

SPACE SYSTEM DEVELOPMENT: LESSONS LEARNED (APPEL-SSD)

AUDIENCE

This course is for engineers, technical managers, and program/project managers engaged in the development or oversight of aerospace systems and components who wish to gain wisdom from NASA's lessons learned.

GOAL

This course enables participants to study more than 30 historical engineering incidents (taken from NASA's extensive internal reservoir of engineering case studies), examine the root causes of these mishaps, and derive applicable real-world lessons from them. They will also understand that rationalizing and accepting deviations from established norms is common yet unacceptable, and that implementing specific strategies and project principles are the best means of preventing failure in the demanding NASA environment. They will also understand the importance of communicating lessons learned, where to find NASA lessons learned database, how and when to use them, and how to best capture and share their own successes and failures as official lessons learned.

LEARNING METHODS

This two-day course is facilitated by former NASA engineering managers with space system development experience and firsthand knowledge about dozens of the engineering mishaps and near-misses examined in the course. Rare archival photographs and videos are included in the multimedia presentation, along with informative personal anecdotes. Participants will review and critique these incidents, perform critical analysis of actual events, and, learn to use this knowledge within their own current projects.

SPECIFIC OBJECTIVES

Upon completion of this course, participants should be able to:

- Identify system-specific lessons from selected historical cases
- Describe the root causes of well known case histories, such as the Apollo 13 oxygen tank and the space shuttle Challenger "normalization of deviance" concept, as well as lesser-known examples from NASA archives
- Demonstrate how normalization of deviance can affect decision points, and how to avoid it
- Translate extracted lessons into concrete strategies for eliminating root causes of problems and use these in daily work
- Support the importance of communicating lessons learned, including mining the NASA lessons learned database as appropriate and capturing and sharing their own successes and failures as official lessons learned.

COMPETENCIES AND TECHNICAL AREAS ADDRESSED

Assessment of historical aerospace mishaps to learn system-specific lessons and root causes; analysis of "normalization of deviance" concept; critical thinking, engineering design and analysis processes, technical decision-making, and project principles; non-analytical aspects of design; application of concrete strategies to eliminate root causes of problems

KNOWLEDGE SHARING

Knowledge Sharing

What We Do

The Academy's Knowledge Sharing initiative promotes excellence in project management and engineering by gathering and sharing knowledge, best practices, and lessons learned from program/project and engineering leaders. This has proven to be an effective strategy for helping to build an agency-wide community of reflective practitioners who understand the necessity of continuous learning and sharing.

Knowledge sharing forums, publications, and multimedia emphasize the power of stories through forums, publications, and multimedia in order to help create a community of practitioners who are reflective and geared toward sharing. The Academy's knowledge sharing events promote organizational learning by helping to connect expert practitioners across the agency.

Masters Forums bring together expert practitioners from NASA, private industry, and other government agencies to share stories and knowledge from past successes and failures that enable innovation and agile solutions to complex problems.

Project Management (PM) Challenge is an annual event that brings together NASA's entire project management workforce to examine current program/project management trends and exchange best practices and lessons learned. This event attracts practitioners from NASA and industry at all career levels, forging an important link between world-class experts and emerging leaders.

Masters with Masters is a series that brings together two master practitioners to reflect on their experiences, lessons learned, and thoughts about upcoming challenges. These sessions, which also incorporate live questions from audience members, engage master practitioners in conversations that yield fresh insights and promote reflection and open sharing. Masters with Masters was developed as part of the Academy's ongoing efforts to create a cohesive community of project management and engineering practitioners across NASA.

Knowledge Forums bring together experts from NASA, industry, and academia to explore issues such as knowledge networks, knowledge capture and preservation, and the challenges of managing and transferring knowledge in a project-based organization.

Publications and multimedia include the award-winning quarterly *ASK Magazine*, the monthly *ASK the Academy* e-newsletter, and case studies used throughout NASA to facilitate discussion and learning. The Academy also offers multimedia case studies, an extensive online library of videos from events, and short clips encapsulating key lessons and insights from world-class experts.

Masters Forum

AUDIENCE

This two-day seminar brings together outstanding project managers and engineers from NASA, private industry, and other government agencies.

GOAL

Through thought-provoking presentations and dynamic group discussions, the Masters Forum enables effective sharing and networking among expert practitioners as well as leaders from other federal government agencies, international space agency partners, universities, and private industry. These events promote organizational learning at NASA by cultivating a community of reflective practitioners and developing the leadership expertise of the agency's veteran and emerging project managers.

LEARNING METHODS

This presentation-based format provides extensive review of specific project topics in order to facilitate discussion, and offers participants the opportunity to interact with presenters and colleagues in order to compare and contrast differing methods of applying project management tools and techniques.

LEARNING OBJECTIVES

The Masters Forum enables participants to:

- Share project management best practices and lessons learned

- Expand their knowledge and understanding of programs and projects at different centers
- Build cross-center relationships
- Extend their personal networks of expert practitioners
- Learn by sharing their own stories with colleagues

See http://www.nasa.gov/offices/oce/appel/knowledge/forums/masters_forums.html

Principal Investigator Team Forum

This forum, a collaborative effort between the Academy and NASA's Science Mission Directorate (SMD), features first-person accounts from past principal investigators (PI), project scientists, project managers, and other veterans of PI-led missions. Master practitioners from past science missions shared stories, perspectives, lessons learned, and best practices with their colleagues.

AUDIENCE

Principal investigators, project managers, and project scientists from across NASA.

GOAL

This two-day forum develops the leadership expertise of the agency's principal investigator (PI) teams by helping PI-led mission teams understand the role of a principal investigator (PI) at NASA, which facilitates personal and team growth and development.

LEARNING METHODS

Stories, shared experiences, and lessons learned from a broad range of science missions enable NASA's PI-led mission teams to engage and share with fellow practitioners.

LEARNING OBJECTIVES

These events enable participants to:

- Share project management, system engineering and science mission best practices and lessons learned
- Cultivate a community of reflective practitioners within teams
- Solidify cross-organizational relationships in support of agency projects
- Build understanding of and expertise in principles, factors, and capabilities that enable PI-led teams to achieve mission success
- Increase ability to execute missions in a way that meets the science objectives within budget and schedule constraints

See http://www.nasa.gov/offices/oce/appel/knowledge/forums/pi_forums.html

NASA Knowledge Forum

AUDIENCE

Knowledge Forums bring together knowledge experts from NASA, industry, and academia to explore issues such as knowledge networks, knowledge capture and preservation, and the challenges of managing and transferring knowledge in a project-based organization.

GOAL

These one-day seminars examine challenges, lessons learned, and best practices in capturing, managing and transferring institutional knowledge in complex organizations.

LEARNING METHODS

Brief presentations and discussions focus on real-world examples. Interactive group activities reinforce key themes and provide sharing and networking opportunities for participants.

LEARNING OBJECTIVES

The Knowledge Forums enable participants to:

- Explore and discuss different aspects of knowledge acquisition, capture, and transfer
- Share best practices and lessons learned in addressing critical organizational challenges to use knowledge effectively
- Cultivate a strong and innovative knowledge community

See http://www.nasa.gov/offices/oce/appel/knowledge/forums/knowledge_forums.html

DEVELOPING COMPETENCIES FOR SUCCESS

Project Management and Systems Engineering Competency Framework

The Academy's developmental framework is based on a rigorous set of competencies that practitioners should have in order to perform their jobs. These competencies were derived from many sources, including extensive interviews with several hundred highly successful project managers and systems engineers at NASA. The resulting competencies were vetted with both internal and external organizations to ensure completeness and accuracy. Since the competencies form the foundation of the development program, they are under configuration control and are reviewed and updated as appropriate. The latest update was done in June 2009.

A key step for NASA's technical practitioners is to understand the competencies associated with their roles. The Academy helps practitioners develop proficiency in their competencies in order to reach the highest level of performance. The diagram below illustrates the required competencies for both project management and systems engineering professionals at NASA. As shown below, the framework consists of five project management competency areas, three systems engineering competency areas, and five competency areas common to both disciplines.

The competency areas describe, in broad terms, the expectations of project management and systems engineering personnel in terms of particular components or functions of the job. There are underlying competencies within each major competency area that provide examples of the knowledge, skills, and behaviors that project managers and systems engineers are expected to possess and/or perform at different career levels. Performance-level descriptions for each competency can be found on the Academy's web site at http://www.nasa.gov/offices/oce/appel/pm-development/pm_se_competencies.html.

To further support individuals as they work to identify their appropriate development activities, the Academy provides a course competency matrix. (See next page.) This tool can be used as a guide in the selection of courses based on competency development and individual learning needs. In addition to competencies, the matrix includes other course elements that may be of interest to individuals considering a particular course. The table represents a snapshot of all courses and includes information such as course duration, audience, and course goals.

PROJECT MANAGEMENT COMPETENCIES

PM 1.0 Project Conceptualization
PM 1.1 Project Proposal
PM 1.2 Requirements Development and Management
PM 1.3 Acquisition Management
PM 1.4 Project Planning
PM 1.5 Cost-Estimating
PM 1.6 Risk Management
PM 2.0 Resource Management
PM 2.1 Budget and Full Cost Management
PM 2.2 Capital Management
PM 3.0 Project Implementation
PM 3.1 Systems Engineering
PM 3.2 Contract Management
PM 4.0 Project Closeout
PM 4.1 Stakeholder Management
PM 4.2 Technology Transfer and Commercialization
PM 5.0 Program Control and Evaluation
PM 5.1 Tracking/Trending of Project Performance
PM 5.2 Project Control
PM 5.3 Project Review and Evaluation

COMMON COMPETENCIES

C 1.0 NASA Internal and External Environments
C 1.1 Agency Structure, Mission, and Internal Goals
C 1.2 NASA Procedures And Guidelines
C 1.3 External Relationships
C 2.0 Human Capital Management
C 2.1 Staffing and Performance
C 2.2 Team Dynamics and Management
C 3.0 Security, Safety, and Mission Assurance
C 3.1 Security
C 3.2 Workplace Safety
C 3.3 Safety and Mission Assurance
C 4.0 Professional and Leadership Development
C 4.1 Mentoring and Coaching
C 4.2 Communication
C 4.3 Leadership
C 4.4 Ethics
C 5.0 Knowledge Management
C 5.1 Knowledge Capture and Transfer
C 5.2 Knowledge Sharing

SYSTEMS ENGINEERING COMPETENCIES

SE 1.0 System Design
SE 1.1 Stakeholder Expectation Definition
SE 1.2 Technical Requirements Definition
SE 1.3 Logical Decomposition
SE 1.4 Design Solution Definition
SE 2.0 Product Realization
SE 2.1 Product Implementation
SE 2.2 Product Integration
SE 2.3 Product Verification
SE 2.4 Product Validation
SE 2.5 Product Transition
SE 3.0 Technical Management
SE 3.1 Technical Planning
SE 3.2 Requirements Management
SE 3.3 Interface Management
SE 3.4 Technical Risk Management
SE 3.5 Configuration Management
SE 3.6 Technical Data Management
SE 3.7 Technical Assessment
SE 3.8 Technical Decision Analysis

STRATEGIC PARTNERS AND EXTERNAL STAKEHOLDERS

Strategic Partners and External Stakeholders

AMERICAN COUNCIL ON EDUCATION (ACE)

The American Council on Education's College Credit Recommendation Service (ACE CREDIT) has evaluated and recommended college credit for 12 of the Academy's courses. The American Council on Education, the major coordinating body for all the nation's higher education institutions, seeks to provide leadership and a unifying voice on key higher education issues and to influence public policy through advocacy, research, and program initiatives.

ACE CREDIT connects workplace learning with colleges and universities by helping adults gain access to academic credit at colleges and universities for formal courses and examinations taken in the workplace or other settings outside traditional higher education. For more than 30 years, colleges and universities have trusted ACE CREDIT to provide reliable course equivalency information to facilitate their decisions to award academic credit.

For more information, visit the ACE CREDIT web site www.acenet.edu/credit

ACE GRADUATE-LEVEL RECOMMENDED COURSES

Designator	Course	Number of Recommended Credits
APM&ASE	Advanced Project Management and Advanced Systems Engineering	2
CESA	Concept Exploration and Systems Architecting	2
DA	Decision Analysis	1
DMA	Design for Manufacturability and Assembly	1
FSE	Fundamentals of Systems Engineering	2
IDEA	Innovative Design for Engineering Applications	1
IPM	International Project Management	3
LCP	Leading Complex Projects	1
LPSE	Life-Cycle Processes and Systems Engineering	1
PAW	Project Acquisition Workshop	1
PM-LAB	Project Management Leadership Lab	3
SAGE	Seven Axioms of Good Engineering	1

NASA ENGINEERING NETWORK (NEN)

The NASA Engineering Network (http://nen.nasa.gov), is an integrated suite of tools that promotes collaboration, learning, and knowledge sharing among NASA's engineers. It connects engineers to other engineers as well as NASA resources through the following:

- NASA's Lessons Learned Database, which provides official, vetted lessons learned from NASA programs and projects. Each lesson includes the summary of the precipitating event and recommendations that drive NASA's engineering training, best practices, policies, and procedures.
- NEN's Engineering Search is an enterprise search engine that mines the knowledge from NASA Lessons Learned and a continually growing number of repositories of interest.
- NEN's Communities of Practice (CoP) are facilitated communities where engineers may interact with their discipline's Technical Fellow, subject-matter experts, and other practitioners to leverage the knowledge, processes, and best practices created and employed by other engineers.

NEN works with the Academy to provide communities of practice for training courses so practitioners can find resources and continue learning after a course is complete. These communities include discussion boards, calendars of upcoming courses, and online resources.

NASA AGENCY TRAINING AND DEVELOPMENT OFFICE

The NASA Agency Training and Development Office extend opportunities to help employees gain the necessary knowledge and skill to fulfill NASA's mission through formal education, training, and on-the-job developmental experiences. The means may be university coursework, traditional classrooms, online learning, satellite broadcast, blended models, or on-the-job training.

The NASA Agency Training and Development Office is responsible for the agency's overall leadership development training needs serving all NASA centers, mission directorates, and mission support organizations. They work in collaboration with the center training offices, Headquarters' functional offices, and stakeholders in the SATERN online learning environment to ensure that employees receive opportunities to build their professional development in three main areas: building leaders, building technical excellence, and building effective organizations. The effort in these areas is focused on results by fostering a culture of honesty, learning, and knowledge sharing.

Specific agency training and development opportunities include short-term residential leadership and business courses, supervisory training, long-term leadership development programs for the GS 11-15 population, professional coaching and mentoring, and agency fellowship programs. All agency training and development offerings are based on the NASA Leadership Model, which can be found at http://www.leadership.nasa.gov

OFFICE OF MANAGEMENT AND BUDGET (OMB) AND FEDERAL ACQUISITION INSTITUTE (FAI)

OMB Requirements for Program/Project Management Certification

In 2007, the White House OMB announced a new set of requirements for project management certification that applies to all civilian agencies, emphasizing the importance of well-trained and experienced project managers to the acquisition process and the successful accomplishment of mission goals. The Federal Acquisition Certification for Program/Project Managers (FAC-P/PM) establishes the necessary competencies, training, and experience requirements for eligible program and project managers in civilian agencies to become certified. The Federal Acquisition Institute (FAI) is the oversight organization for this requirement. Visit http://www.fai.gov for more information.

To meet OMB's requirements, NASA is required to certify existing and future experienced P/PMs who manage high-visibility projects defined as major acquisitions per NPR 7120.5D.* Center senior management, with guidance from the Program Management Council, is responsible for determining which positions fall under this threshold. At this time, it is not mandatory for P/PMs assigned to non-major projects or programs to be certified.

Continuous Learning Requirements for Certified P/PMs

Certified NASA P/PMs must complete eighty continuous learning points (noted as CPEs in SATERN) every two years to maintain certification. All APPEL courses and activities are eligible for credit toward recertification. The list of Academy courses and their associated CPEs as well as other self-recordable items can be found in the SATERN Recertification Catalog. To view a list of P/PM recertification-applicable courses and activities in SATERN, please log in to a SATERN learner account and click the "Catalog" tab.

Please check the SATERN Recertification Catalog frequently for updates as center, discipline, and other agency-approved courses and activities will be added on an ongoing basis. Contact your Center Training Office for additional details or visit the Academy web site.

PROJECT MANAGEMENT INSTITUTE

PMI Registered Education Provider

PMI is the leading membership association for the project management profession and is recognized around the world for the programs they conduct with governments, organizations, and industries as they recognize and embrace project management.

The Academy is a Registered Education Provider (REP) approved by PMI to issue Professional Development Units (PDU) for its training courses and knowledge sharing events.

Courses offered by PMI REPs are preapproved for contact hours in fulfillment of certification eligibility requirements, as well as PDUs to fulfill the Project Management Professional (PMP®) Continuing Certification Requirements. The REP program has been designed to enhance the ongoing professional development of PMI's members, those credentialed through PMI, and others in the project management profession. The Academy currently offers more than thirty courses with PDU credits. The numbers of PDUs are shown on each course description. (A list of APPEL courses and the relevant PDUs can also be found on the APPEL web site: http://appel.nasa.gov.)

PMI's Certification Programs

Project management practitioners can advance their careers through PMI's globally recognized certification program that consists of a comprehensive certification program for professionals with varying levels of experience. The credentials are as follows:

- Certified Associate in Project Management (CAPM®)
- Project Management Professional (PMP®)
- Program Management Professional (PgMPSM)

The Certified Associate in Project Management (CAPM®) Credential is for project team members who:

- Provide subject-matter expertise (e.g., marketing, finance, customer care, processing, fulfillment)
- Serve as project team sponsors, facilitators, liaisons, or coordinators

The Project Management Professional (PMP®) Credential is for candidates who:

- Perform their duties under general supervision and are responsible for all aspects of the project for the life of the project
- Lead and direct cross-functional teams to deliver projects within the constraints of schedule, budget, and resources
- Demonstrate sufficient knowledge and experience to appropriately apply a methodology to projects that have reasonably well-defined project requirements and deliverables

The Program Management Professional (PgMPSM) Credential is for candidates who:

- Under minimal supervision, are responsible and accountable for the coordinated management of multiple related projects directed toward strategic business and other organizational objectives. These programs contain complex activities that may span functions, organizations, geographic regions, and cultures. Program managers build credibility, establish rapport, and maintain communication with stakeholders at multiple levels, including those external to the organization
- Define and initiate projects and assign project managers to manage cost, schedule, and performance of component projects, while working to ensure the ultimate success and acceptance of the program. Program managers maintain continuous alignment of program scope with strategic business objectives and make recommendations to modify the program to enhance effectiveness toward the business result or strategic intent. Program managers are responsible for determining and coordinating the sharing of resources among their constituent projects to the overall benefit of the program
- Possess the knowledge and skills needed to be effective in both the project and business or government environment and to make decisions that accomplish strategic objectives. In addition, the program manager should have advanced skills in finance, cross-cultural awareness, leadership, communication, influence, negotiation, and conflict resolution

For more information on the certifications, visit PMI's web site: http://www.pmi.org/CareerDevelopment/Pages/Obtaining-Credential.aspx.

What Credential Am I Eligible For?

The Academy provides a systematic approach to professional growth for program and project managers ranging from early on in their careers to more advanced levels. The figure below aligns the Academy's four-level development framework for project managers with PMI's current certification levels. By reviewing these requirements, individuals can determine the preparation process and relevant level of certification based on career level.

NASA PROJECT MANAGEMENT DEVELOPMENT FRAMEWORK AND PMI CERTIFICATION ALIGNMENT

Project Management Development Framework	PMI Certifications
Level 1: Project Team Members NASA employees who are at the beginning of their project management careers	Certified Associate in Project Management (CAPM): Must meet the following education and experience requirements and then pass exam: • Must have 1,500 hours of work on a project team or 23 hours of formal education
Level 2: Managers of Small Projects NASA project practitioners who have established a solid base of technical expertise and who independently manage definite portions of projects	
Level 3: Managers of Large Projects NASA project practitioners who have had prior experience in projects at a supervisory level and manage larger projects	Project Management Professional (PMP): Must meet the following education and experience requirements and pass exam: • 4,500 hours in a position of leading and directing tasks and 36 months of PM experience • 7,500 hours in a position of leading and directing tasks and 60 months of PM experience without a bachelor's degree • 35 hours of PM education
Level 4: Program Managers Upper-level managers serving as leaders of entire projects and programs of the organization as a whole	Program Mgmt Professional (PgMP): Over the past 15 consecutive years, must have 4 years of project management and 4 years of program management experience; without BS, individual must have additional 3 years of program management experience

PMI Professional Development Units (PDU) for APPEL Courses

In order to satisfy Continuing Certification Requirements (CCR) and maintain an active credential status, individuals who have attained the PMP and/or Program Management Professional credential(s) must accrue and report a minimum of 60 professional development units (PDUs) during each three-year CCR cycle. The PDU is the measuring unit used to quantify approved learning and professional service activities. Certificants are responsible for reporting qualifying activities as they occur. PDUs should be reported using the Online PDU Resources system accessible from a section of the PMI web site: https://www.pmi.org/ccrs/.

Below is a list of PMI-registered APPEL courses, the PMI Course ID, the number of assigned PDUs and course duration.. Upon claiming your PDUs, you will need to have the Provider ID number, which is 1895.

APPEL Course ID	Course Title	PMI Course ID	PDU	Duration (Days)
AEVMT	APPEL - Advanced Earned Value Management Topics: Recognizing EVM and Scheduling Gaming, Abuse and Data Manipulation	AEVMT05	7	1
APM&ASE	APPEL - Advanced Project Management and Advanced Systems Engineering	APMSE03	39	4
APP	APPEL - Assessing Project Performance	APP006	15	12
BEVMB	APPEL - Beyond EVM Basics: Baseline Control, Management Reserve and Performance Indicators	BEVM07	15	2
BSB	APPEL - Beyond Scheduling Basics: Analysis, Control, and Reserve Planning	BSB008	7	1
CESA	APPEL - Concept Exploration and System Architecting	CESA30	36	4.5
CRM	APPEL - Continuous Risk Management	CRM010	23	3
CTI	APPEL - Communicating Technical Issues	CTI009	15	2
DA	APPEL - Decision Analysis	APPEL - DA	16	2
EVMO	APPEL - Earned Value Management Overview	EVM012	7	1
FSE	APPEL - Fundamentals of Systems Engineering	FSE031	40	5
ICS	APPEL - Integrating Cost and Schedule	ICS013	15	2
IDEA	APPEL - Innovative Design for Engineering Applications	IDEA32	24	3
IEVMA	APPEL - Integrating EVM with Acquisition	IEVMA27	4	.5

APPEL Course ID	Course Title	PMI Course ID	PDU	Duration (Days)
IPM	APPEL - International Project Management	IPM014	40	4.5
LCP	APPEL - Leading Complex Projects	LCP015	23	3
NBP	APPEL - NASA's Budgeting Process	NBP016	7	1
NG	APPEL - Negotiations	NEG018	7	2
PAW	APPEL - Project Acquisition Workshop	APPEL - PAW	20	2.5
PBSOW	APPEL - Performance-Based Statement of Work	S20008	14	2
PM&SE	APPEL - Project Management and Systems Engineering	PMSEA01	79	10
PM-LAB	APPEL - Project Management Leadership Lab	PMLAB19	31	4.5
PMP	APPEL - Passing the Project Management Professional Exam	PPMP27	27	3.5
PPAC	APPEL - Project Planning Analysis and Control	FOU150	34	5
PRPS	APPEL - Project Review Processes and Strategies	PRPS21	32	4
RM	APPEL - Risk Management	RM022	7	1
SAGE	APPEL - Seven Axioms of Good Engineering	SAGE33	24	3
SCC	APPEL - Scheduling and Cost Control	SCC023	31	4
SEMP	APPEL - Developing and Implementing a Systems Engineering Management Plan	SEMP11	23	3
STPS	APPEL-– Strategic Thinking for Project Success	APPEL - STPS	24	3
TL	APPEL - Team Leadership	TL0024	19	2.5
UEVM	APPEL - Understanding Earned Value Management	UEVM25	15	2
UPS	APPEL - Understanding Project Scheduling	UPS26	7	1
	4D 3 Day Workshop for Intact Project Teams	4DWKS3	26	3
	4D 2 1/2 Day Workshop for Intact Project Teams	4DWKS25	22	2,5
	4D 2 Day Workshop for Intact Project Teams	4DWKS2	18	2

2011 PLANNING CALENDAR

2011 Planning Calendar

http://appel.nasa.gov

Month	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Dec 2010	26	27	28	29	30	31	1
Jan 2011	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
	16	17	18	19	20	21	22
	23	24	25	26	27	28	29
	30	31	1	2	3	4	5
Feb 2011	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
	27	28	1	2	3	4	5

Month	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Mar 2011	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
	27	28	29	30	31	1	2
Apr 2011	3	4	5	6	7	8	9
	10	11	12	13	14	15	16
	17	18	19	20	21	22	23
	24	25	26	27	28	29	30

Month	Sun	Mon	Tue	Wed	Thu	Fri	Sat
May 2011	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30	31	1	2	3	4
June 2011	5	6	7	8	9	10	11
	12	13	14	15	16	17	18
	19	20	21	22	23	24	25
	26	27	28	29	30	1	2

Month	Sun	Mon	Tue	Wed	Thu	Fri	Sat
July 2011	3	4	5	6	7	8	9
	10	11	12	13	14	15	16
	17	18	19	20	21	22	23
	24	25	26	27	28	29	30
	31	1	2	3	4	5	6
Aug 2011	7	8	9	10	11	12	13
	14	15	16	17	18	19	20
	21	22	23	24	25	26	27
	28	29	30	31	1	2	3

Month	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Sep 2011	4	5	6	7	8	9	10
	11	12	13	14	15	16	17
	18	19	20	21	22	23	24
	25	26	27	28	29	30	1
Oct 2011	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
	16	17	18	19	20	21	22
	23	24	25	26	27	28	29
	30	31	1	2	3	4	5

Month	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Nov 2011	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
	27	28	29	30	1	2	3
Dec 2011	4	5	6	7	8	9	10
	11	12	13	14	15	16	17
	18	19	20	21	22	23	24
	25	26	27	28	29	30	31

PHILOSOPHY

It is the intent of the Academy to ensure that NASA program/project managers, engineers, and systems engineers be supported in acquiring the knowledge and skills that will be required for their success at increasing levels of assignment complexity within the agency. The satisfactory completion of any or all the development activities should enhance an individual's capabilities, probability of success, and value as an asset to NASA. As individuals demonstrate improved quality in their job performance, the opportunities for assignment to increased levels of responsibility should be a possibility. An individual's competence will always be the critical factor in his or her consideration for advancement.

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NP-2010-09-678-HQ